

RubberWorld

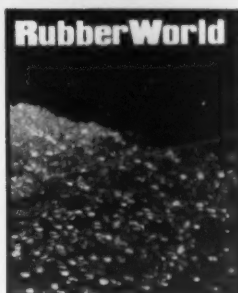
The technical service magazine for the rubber industry

Volume 201, No. 2

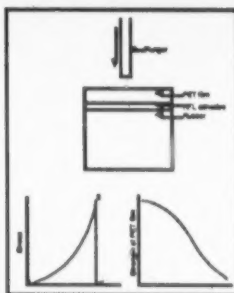
November 1989

Bonding MPR
Adhesion of PET tire cord
Crosslinking system effect on HNBR

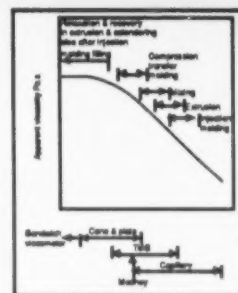




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PET tire cord adhesion
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Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.

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by Jon Menough, contributing technical service editor. This month's column looks at new methods of surface coating and hardening, particularly ion implantation.

15 Patent News

edited by Bob Samples, Akron Rubber Development.

16 Bonding melt processible rubber

by Ronald E. Myrick, Du Pont. The author describes principles and techniques useful for bonding this proprietary melt processible rubber to a variety of substrates.

19 Properties of a new carboxylated VP-latex on the adhesion of PET tire cord to rubber

by Hiroshi Hisaki and Souichi Suzuki, Nippon Zeon. Improved adhesion is achieved by preventing amine compounds from penetrating the adhesive layer.

25 Crosslinking system effect on processing behavior and performance profile of HNBR

by J. Thormer, J. Mirza, Z. Sventivanyi, W. Obrecht and E. Rohde, Bayer AG. Improvements in compounding are described for vulcanizing highly saturated nitrile rubber both with sulfur and with peroxides.

31 The TMS rheometer

by R.S. Trim, Negretti Automation Ltd. The uses and characteristics of this biconical instrument are described.

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Cover photo courtesy of Du Pont.

A Lippincott & Peto Publication

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Audit
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Editorial

Another crisis is upon us, but this one should be beneficial to many individuals. The October 23 issue of *Chemical & Engineering News* in its special report "1990 employment outlook" warns there is a crisis developing in the supply of scientists and engineers entering the workforce. Quoting the National Science Foundation, the report says that by the year 2006, the U.S. will have a cumulative shortfall of 675,000 people with bachelor's degrees in natural science and engineering. "For the first time since the late 1970s, recruiters report that there seem to be more jobs for new B.S. chemical engineers and Ph.D. chemists than there are qualified candidates to fill them," the report says, indicating that the number of degrees in chemistry awarded last year was the lowest in two decades.

This view was also presented by Randall Caldwell at the recent Rubber Division meeting in Detroit. Caldwell is a recruiter in the polymer industry for A.M.C.R. Inc. in Akron and gave a paper on "Career opportunities in the 1990s." He sees the same problem that *C&E News* wrote about and thinks it's a good news/bad news situation. He charted the growth of salaries in the industry, stating there has been a four- to five-fold increase since 1960, but "you ain't seen nothin' yet." Supply and demand is the reason. "Chemists, engineers, scientists and technicians in our industry will be in short supply. Demand for trained, talented, technical people will far exceed the available supply," he said. So those who weathered recessions, restructurings, LBOs, consolidations and the leaner and meaner storms are now going to be in the catbird's seat. Caldwell sees the chemists and engineers as the driving force for the industry in the coming decade and that their rewards - salaries and bonuses - will advance to most gratifying levels, on par with their accomplishments.

The bad news of this scenario is that the rubber industry is going to be competing with numerous other industries for the good, qualified people presently employed and the future graduates. Caldwell says that the automotive industry is paying technical graduates \$2,000 to \$4,000 more per year to start, just to make sure they stay around. The *C&E News* report cites bonuses of up to \$10,000. It's going to be a seller's market for the qualified. Not especially good news for the companies, but at least the money will be spent on those trying to advance the industry.

Don R. Smith
Editor

RubberWorld

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OTHER LIPPINCOTT & PETO PUBLICATIONS

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- Blue Book: Materials, Compounding Ingredients, and Machinery for Rubber

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Business Briefs

at its wire cloth extruder screen and specialty filter manufacturing operations in Houston, TX. The addition triples plant capacity and includes a new quality control facility, and expanded engineering and product development departments.

Radio Frequency, headquartered in Millis, MA, acquired the dielectric business and assets of **W.T. LaRose & Associates** of Cohoes, NY. The acquired business will be conducted by **LaRose RF Systems**, a new subsidiary of Radio Frequency.

Barnant, Barrington, IL, acquired **Gilmont Ind.**, Great Neck, NY, and made it a wholly-owned subsidiary. Plans are under way to incorporate the complete manufacturing operation into to main Barnant facility in Barrington.

The Simon-Macawber division of the **Simon Group** acquired **Vac-U-Max**, an independently owned British company. Vac-U-Max is licensed to sell vacuum pneumatic conveying equipment in the UK, Scandinavia and western Europe.

Goettfert has been established as the North American subsidiary for the German firm of **Goettfert Werkstoff Pruefmaschinen**, manufacturers of high shear rheology testing equipment. The new facility will be located in Rock Hill, SC, with operations starting up January 1.

MANAGER QUALITY ASSURANCE

Day International Company, a wholly owned business unit of M.A. Hanna Company is seeking an experienced Manager, Quality Assurance. Day is a world leader in rubber printing blankets for the printing industry and rubber replacement parts for the textile industry.

This position will be based in Asheville, North Carolina and will be accountable for the Printing Products' quality program at the Asheville facility. Qualified candidates will have a B.S. or B.A. degree in engineering, chemistry or related fields with 5 to 7 years experience in quality assurance at the management level. Prefer individual with CQE certification and strong communication and organizational skills. Strongly prefer experience in rubber and plastics industry or with a company supplying the automotive industry. Experience in designing and installing a quality program a real plus.

We offer excellent benefits, a relocation package, and a salary commensurate with qualifications. Qualified candidates should send resume in confidence along with salary history to:

Director, Human Resources

Day International

P.O. Box 1077

Arden, NC 28704

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Contracts, licenses

The **EPIC-Hanna Blending and Compounding Center** was established on the **University of Akron** campus through a \$190,000 gift from **M.A. Hanna** that will match capital funds provided by **Edison Polymer Innovation Corp. (EPIC)**. The 3,500 sq. ft. facility is available to polymer companies for experiments on plastic and rubber materials, and features a special laboratory for carbon-black compounding. In addition to industry, faculty and graduate students from **Akron** and **Case Western Reserve University**, **Cleveland**, will use the center's equipment for their research. EPIC will guarantee the center's operating costs for the next three years. Equipment currently available at the facility includes a twin screw extruder, **Farrel Banbury** mixer, internal mixer, single screw extruder with static mixer, polymer engineering center twin screw extruder and a two-roll mill. The University will offer hands-on training in extrusion and compounding technology to Hanna employees.

Degussa AG, Federal Republic of Germany, and **Dow Deutschland** will work together in the area of polycarbonate. Dow will deliver its polycarbonate granulate to Degussa's production plant in **Wolfgang, Hanau**, where the raw product will be processed into transparent or colored panels of solid and hollow design. Production start-up is scheduled for the beginning of 1990.

GenCorp Automotive signed a 10-year technical licensing agreement with **Toyo Tire & Rubber** under which GenCorp will produce vibration control products incorpo-

RMA tire report - August
(figures in thousands of units)

Passenger tires	YTD '89	YTD '88	% change
Shipments			
original equipment	35,447	35,363	0.2
radial	30,927	30,131	2.6
replacement	101,607	101,620	-
radial	96,389	94,943	1.5
export	8,616	6,300	36.8
radial	8,030	5,572	44.1
total	145,671	143,283	1.7
radial	135,347	130,646	3.6
Production	120,422	116,442	3.4
radial	112,445	105,838	6.2

Truck & bus tires			
Shipments			
original equipment	5,804	5,879	-1.3
radial	4,818	4,293	12.2
replacement	23,221	22,188	4.7
radial	13,661	12,914	5.8
export	2,384	2,157	10.6
radial	1,760	1,672	5.3
total	31,410	30,223	3.9
radial	20,239	18,879	7.2
Production	26,042	24,300	7.2
radial	17,360	14,877	16.7

RubberWorld

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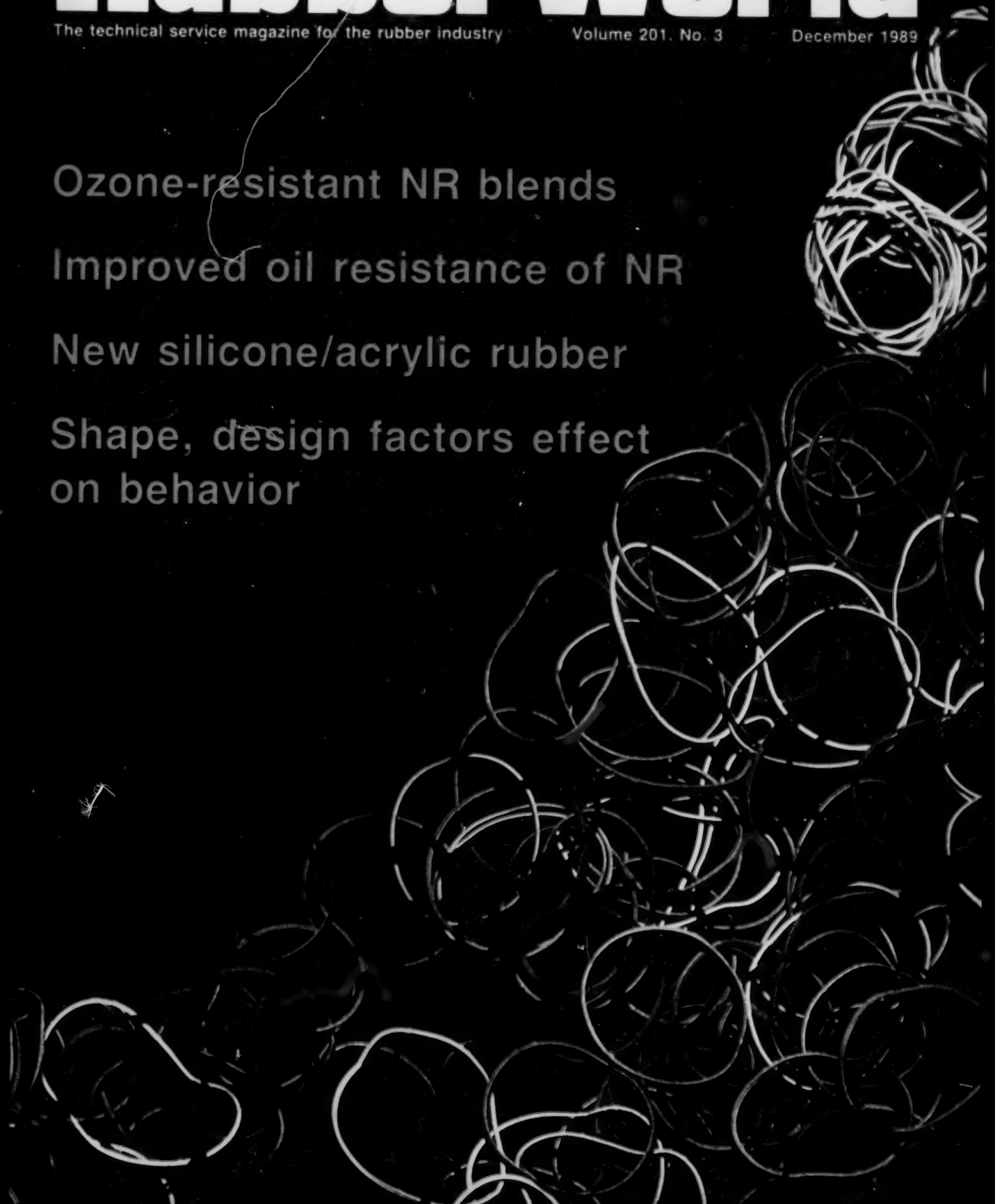
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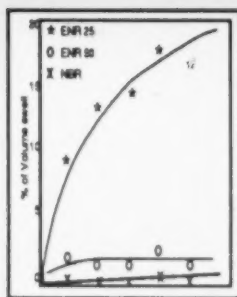
Ozone-resistant NR blends

Improved oil resistance of NR

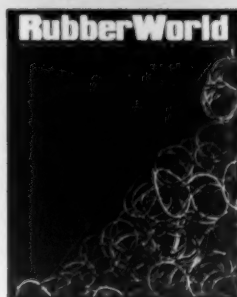
New silicone/acrylic rubber

Shape, design factors effect
on behavior

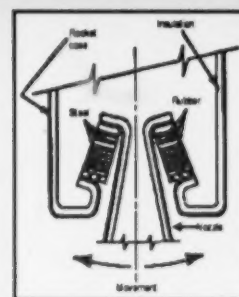




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Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.

11 Patent News

edited by Bob Samples, Akron Rubber Development.

12 Tech Service: Gas injection molding?

by Jon Menough, contributing technical service editor. This month's column looks at the benefits and drawbacks of gas injection molding, along with its applications to thermoplastic elastomers.

14 Ozone-resistant natural rubber blends

by Frank C. Cesare, Uniroyal Chemical. The author finds that the use of small amounts of liquid EPDM provides increased ozone resistance, yet permits retention of an overall good property balance.

20 Properties of new silicone/acrylic rubber

by Itsuki Umeda, Y. Takemura, J. Watanabe and Y. Funahashi, Japan Synthetic Rubber. The authors find that silicone rubber/acrylic rubber composite has very useful properties for oilseals, o-rings, gaskets and certain hoses.

25 Improved oil resistance of natural rubber

by M.D. Salleh Nordin, Rubber Research Institute of Malaysia. Increasing the level of epoxidation improves the oil resistance of natural rubber.

29 Effect of shape and other design factors on rubber behavior

by J.F. Sommer, consultant. These properties are thoroughly described and explained in relation to applications as bridge bearings, earthquake bearings and rocket nozzle bearings.

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Cover

Cover photo courtesy of The Malaysian Rubber Bureau.

A Lippincott & Peto Publication

The Audit Bureau

Editorial

This time of year around here is the directory season. We are gathering information for directories of instrumentation and testing equipment suppliers, independent testing labs and custom services suppliers for *Rubber World*, automotive parts and material suppliers for *Automotive Polymers & Design* (a Lippincott & Peto magazine), along with editing the voluminous *Blue Book: materials, compounding ingredients, machinery and services for rubber*. If you supply the rubber industry one of our editors has contacted you recently for your company's information. Hopefully you returned it. Hopefully by the deadline. Hopefully it was legible. And hopefully, if you do supply the rubber industry, you were surveyed.

The editors have little control over the first three items and some more over who gets surveyed. We feel that over the years we have compiled some comprehensive directories of suppliers to various segments of the rubber industry. Some companies might not be listed, most likely because they chose not to be included. But sometimes our mailings may miss someone and we usually hear about it after the fact. You are reading this before these lists get published, and if you believe your company might not be included in one of the aforementioned directories, call me, we'll correct the oversight.

With this being directory season (we know other publishers are asking for information at this time as well) here are some tips we thought we would pass along, not only to benefit us, but those who use these directories at work:

- *Make sure any inclusion is legible* - It's amazing what some people call writing. Signatures that look like EKG lines and words without any discernible letters pop up. We would question the author over the phone if we knew who signed the return.

- *Make sure request is returned by the deadline* - We usually give plenty of lead time from when the request is made. It's ironic that the companies with the most Blue Book listings have plenty of time to respond, while those with 10 minutes of editing will return weeks past the deadline.

- *Follow the directions* - Don't provide information that doesn't fit the format or pertain to the request

- *Make sure any inclusion is legible* - This cannot be stressed enough.

Hopefully this directory season you'll be easy on us. So if you have a directory request sitting around the desk, complete it and return it now. Legibly.

Don R. Smith
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Business Briefs

the pellet and fluff storage center, a motor control center, control room and cooling tower. An investigation is pending, and an official cause has yet to be established. An undetermined amount of polyethylene inventory stocked at the site was destroyed.

Phillips Petroleum reported third quarter net income of \$87 million and total revenues of \$3.1 billion.

PPG reported third quarter net earnings of \$106.7 million on sales of \$1.36 billion.

Rubbermaid's third quarter sales were \$352 million and earnings were \$32.6 million.

Specialty raw materials distributor, Sethco, changed its name to Votech, a joint venture of Seegott, Solon, OH and E.T. Horn, La Mirada, CA.

Standard Products achieved sales of \$151.0 million and net income of \$1.395 million for the first quarter of 1990.

Sumitomo Chemical reported net income of \$310,913 on sales of \$7.121 million for 1988.

UCB showed a profit of 664 BF million after tax for the first half of 1989, and reported net sales of 17.7 BF million.

Union Carbide has introduced a new chemistry system which is said to allow production of virtually all flexible polyurethane foams without the use of chlorofluorocarbons or methylene chloride. The products are marketed under the name Geolite Additives, used to produce flexible foam cushioning.

Markets, News

The United States International Trade Commission unanimously determined on November 1, under section 733(a) of the Tariff Act of 1930, that there is no reasonable indication that an industry in the United States is materially injured, or threatened with material injury, by reason of imports of polychloroprene from France and the Federal Re-

public of Germany that are allegedly sold at less than fair value. The investigation was prompted when Du Pont filed a petition September 22, seeking to impose a duty on the exporting countries to correct the difference between their prices and U.S. prices. Du Pont believed the countries were unfairly dumping imports of polychloroprene. Specifically, the suit charged Bayer AG of West Germany and Distngil SA of France with unfair dumping.

Associated Rubber, Quakertown, PA, and Lawrence Industries, Burlington, NC, were presented Rubber Manufacturers Association Safety & Health Improvement Awards for excellence. Awards for "Most Improved" were presented to Cooper Tire & Rubber, Findlay, OH; Ottawa Rubber, Holland, OH; and Rubber Rolls, Pittsburgh, PA. Improvement awards were presented to Castle Rubber, Butler, PA; Molded Dimensions, Port Washington, WI; Pawling, Pawling, NY; Sperry Rubber & Plastics, Brookville, IN; and West American Rubber from Orange, CA.

Overcapacity for thermoplastic elastomers will occur in global markets over the next five years, according to "TPE 2000," a jointly produced study conducted by Gabris International and Harborside Research Group. Contributors to the overcapacity are new competing materials such

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**For Further Information,
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Projected TPE growth - North America and Europe

% AAGR*, all TPEs, by major market,
1988 to 1993, for a 375,000 ton business

Major market	% AAGR	
	North America	Western Europe
Wire & cable	5.0%	10.7%
Hose & tubing	4.0%	7.3%
Polymer modification (1)	7.5%	4.0%
Automotive (2)	2.7%	3.0%
Film & sheet	12.0%	8.0%
Other fabrications	6.0%	6.0%
Medical	15.0%	9.0%
Footwear (3.6%)	(3.3%)	
All markets	7.6%	2.0%

* Average annual growth rate
(1) Includes blends & alloys
(2) Except wire & cable

Source: Gabris Int'l.;
Harborside Research

Business Briefs

as PVC-nitrile TPEs, evolving reactor grades of polypropylene TPOs and announced new capacity for styrenic block copolymers. Contributing to the slower growth of TPEs are the facts that many North American applications are approaching saturation; environmental concerns will replace halogenated elastomers with TPEs, which compete with nonhalogenated elastomers; resin suppliers and compounders are increasing their focus on the development of higher added-value engineering thermoplastic elastomers; and finally, with a unified European standard equivalent to UL 62 for the wire and cable industry occurring by 1992, the market for TPEs will be more consolidated. Presently, Europe's lack of a unified standard has resulted in a more fragmented market for TPE than in North America.

Overall growth in thermoplastic elastomer consumption is expected to average 7.6 percent annually throughout 1992 in North America, but only 2.0 percent in Western Europe during the same period. Medical, film and sheet, and polymer modification, currently emerging businesses, will provide the highest growing markets in North America.

In western Europe, wire and cable applications could increase significantly as replacements for halogenated elastomers which are likely to be banned for environmental and toxicity reasons.

Production of rubber processing chemicals experienced a decrease of 8 percent for 1988, from 353 million pounds produced in 1988 compared to 1987's figure of 382 million pounds. Consequently, sales for 1988 decreased from 266 million pounds, valued at \$424 million, compared with 289 million pounds sold in 1987 worth \$359 million.

Production of cyclic rubber-processing chemicals experienced a decrease compared to 1987 production figures. Production in 1988 amounted to 318 million pounds, while 1987's figure was 354 million pounds, or 10 percent less. 1988 sales saw only 236 million pounds sold, valued at \$397 million, compared to 263 million pounds valued at \$336 million sold in 1987. Of the total cyclic rubber-processing chemicals produced in 1988, antioxidants, antiozonants and stabilizers accounted for 70 percent, and accelerators, activators and vulcanizing agents for 26 percent.

Rubber processing chemicals - U.S. production and sales, 1988

Rubber processing chemicals	Sales			Average unit value ¹ Per pound
	Production 1,000 pounds	quantity 1,000 pounds	Value 1,000 dollars	
Grand total	352,730	265,665	423,913	\$1.60
Cyclic total	318,482	236,296	397,388	1.66
Accelerators, activators, and vulcanizing agents, total	83,228	64,662	107,190	1.66
Thiolate derivatives, total	78,507	60,733	91,743	1.51
N-tert-butyl-2-benzothiazolethiobenzenesulfonamide	19,407	24,158	41,550	1.72
2,2'-Dithiobis [benzothiazole]	11,957	13,150	13,681	1.04
All other thiazole derivatives	47,143	23,425	36,512	1.56
All other accelerators, activators, and vulcanizing agents ^{2,3}	4,721	3,929	15,447	3.93
Antioxidants, antiozonants, and stabilizers, total	223,662	160,343	255,530	1.59
Amino compounds, total	133,681	104,164	168,354	1.62
Substituted p-phenylenediamines	84,987	55,797	103,551	1.86
All other amino compounds ⁴	48,694	48,367	64,803	1.34
Phenolic and phosphite compounds, total ⁵	89,981	56,179	87,226	1.55
Polyphenolics	7,813	6,904	24,083	3.49
Phenol, hindered	(6)	1,304	2,654	2.04
All other phenolic and phosphite compounds	82,168	47,971	60,489	1.18
All other cyclic rubber processing chemicals ⁷	11,592	11,294	34,618	3.07
Acyclic Total	34,248	29,370	26,525	.90
Accelerators, activators, and vulcanizing agents	5,878	4,726	11,479	2.43
All other acyclic rubber processing chemicals ⁸	28,370	26,644	15,046	.61

¹ Calculated from unrounded figures.

² Includes aldehyde-amine reaction products, dithiocarbamates, and other accelerators, activators, and vulcanizing agents.

³ Data on dithiocarbamates included in this table are from materials used chiefly in the processing of natural and synthetic rubber. Data on dithiocarbamates, which are used chiefly as fungicides, are included in the section on "Pesticides and related products."

⁴ Includes aldehyde- and acetone-amine reaction products and other amines.

⁵ Also includes other antioxidants, antiozonants, and stabilizers.

⁶ Reported data were accepted in confidence and may not be published, or no data were reported.

⁷ Includes blowing agents, peptizers, and other cyclic rubber-processing chemicals.

⁸ Includes polymerization regulators, shortstops, and other acyclic rubber processing chemicals.

Source: U.S. International Trade Commission

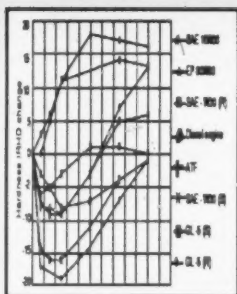
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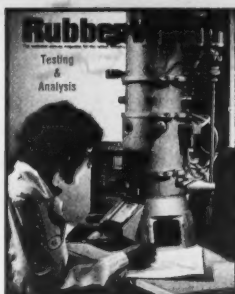
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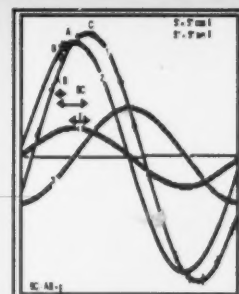
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8 Tech Service: Accident investigation

by Jon Menough, contributing technical service editor. This month's column looks at the importance of investigating accidents in order to understand why they happen and to ensure that they do not recur.

12 Patent News

edited by Bob Samples, Akron Rubber Development.

13 TA techniques for the rubber laboratory

by Janet L. Laird and George Liolios, Du Pont. Thermal analysis techniques such as differential scanning calorimetry, thermogravimetric analysis and thermomechanical analysis are examined.

20 Stiffness measurement for evaluating heat resistance of rubber

by Boris Dinzbarg and Robert Bond, CR Industries. The determination of the heat resistance index and measurement of the kinetics of stiffness change at small deformations is proven an effective method for defining the resistance of rubber to aging in different aggressive media.

25 New rheometer and Mooney technology

by Patrick J. DiMauro, Monsanto Co., and J. de Rudder and J.P. Etienne, Monsanto - Europe. This article reviews the new design features of the company's oscillating disk rheometer, rotorless or moving-die rheometer and Mooney viscometer, and then shows some reproducibility data from production built units.

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Directory of independent testing laboratories with a grid showing testing offered.

39 Instrumentation and test equipment suppliers

Directory of instrumentation and test equipment with a grid showing instrumentation offered.

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Editorial

Happy New Year, and for that matter, happy new decade. Let's hope the 90s provide a little more stability to the rubber industry than the 80s did, but I doubt it. The political events in Eastern Europe coupled with the market unification of the remainder of Europe scheduled for 1992 already portend significant changes will take place. It might be hard to top the 80s with its friendly and hostile takeovers, leveraged buy-outs and aggressive maneuvers by foreign rubber firms in the North American market.

The tire segment of the industry bore most of the change in the decade, but the non-tire sector appears to be going through similar changes. Akron, the rubber capital of the world, only produces specialty tires. Firestone is owned by Bridgestone. General Tire is owned by Continental. Armstrong was bought by Pirelli. Uniroyal and BFGoodrich merged tire operations and Michelin will soon own that. Goodyear survived a hostile takeover attempt but at a serious cost. Goodyear also lost its number one ranking in the rubber industry. Polysar is now Nova Corp. I could go on.

It's hard to imagine the decade we just entered being as hectic but you had better be prepared. Some predicted a restructuring of the industry, but no one guessed the severity or quickness with which it came about. So what lies ahead for the 90s? Obviously political events will have a major bearing on business. Just when companies were planning strategies for the upcoming European Economic Community, Eastern Europe becomes a factor. The effects of the numerous LBOs will begin to bear on company decisions as well. But I'm guessing that all of these factors are going to take a back seat to the environment in the coming 10 years.

The people are going to demand (it has already begun) cleaner air, water, land and workplace. Company planners would be wise to scrutinize each operation and ascertain just how to reduce or eliminate pollution in each area because the population is going to demand it. It would behoove the industry, just as the plastics industry is doing, to initiate the action instead of having it legislated for you. Indiscriminate pollution, which appears to have little concern for the environment, will not be tolerated. The industry must start working with governments on a local and national basis to show that a cleaner environment is also our concern and not something that we're going to do only if forced. Because if it comes to that, you most likely won't like the legislation.

Don R. Smith
Editor

RubberWorld

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Business Briefs

proprietary PO/SM technology and Mobil/Badger EB technology. The plant will have an annual rated capacity of 500 million pounds of PO and 1,125 million pounds of styrene. Field construction will begin in the first quarter of 1990, with startup scheduled for the fourth quarter of 1991.

Reed Plastics added an Atlas Xenon arc weatherometer to its Albion, MI, facility, allowing the company both carbon arc and xenon arc capabilities in its service to automobile manufacturers. The Atlas Ci35a xenon weatherometer tests the durability of textiles, plastics, coatings and colorants.

Procedyne, a manufacturer of fluid bed retort furnaces, recently relocated to expanded facilities in New Brunswick, NJ. The 60,000 sq. ft. facility provides for major expansion and modernization of Procedyne's production facilities, laboratories and general offices.

The AVEC, Inc. business unit of M.A. Hanna located in Vonore, TN, completed the previously announced purchase of Gulf Plastics Ltd., of Vancouver, British Columbia, for undisclosed terms.

Chemische Werke Lowi formed a wholly owned subsidiary in the United States which will be known as Lowi Chemical Corp. Corporate offices will be maintained in Akron, OH, and warehouses have been established through-

out the United States. Lowi Chemical will market and distribute the line of Lowinox phenolic antioxidants to the rubber industry. Chemische Werke Lowi also plans to expand its Waldkraiburg, West Germany production facility, which should be completed in 1990.

International Scientific Instruments, suppliers of electron microscopes, relocated its headquarters from Milpitas, CA, to a 24,000 square foot complex in Pleasanton, CA. The facility will provide expanded applications development and product demonstration facilities, as well as house a greatly expanded inventory of instrument spare parts.

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**For Further Information,
contact Jon Menough**

P.O. Box 1011
Lodi, CA 95241
(209) 334-3701

RMA rubber report through September (figures in metric tons)

	YTD 1989	YTD 1988	% chg.
Total new rubber			
New rubber available	2,673,843	2,573,646	3.9
Imports	951,833	826,893	15.1
Exports	375,536	435,537	-13.8
Apparent consumption	2,268,685	2,147,371	5.6
Total natural rubber			
Imports	696,865	632,380	10.2
Exports	24,590	37,649	-34.7
Apparent consumption	687,017	633,131	8.5
Total synthetic rubber			
Production	1,722,008	1,746,752	-1.4
Imports	254,968	194,513	31.1
Exports	350,946	397,888	-11.8
Apparent consumption	1,581,663	1,514,234	4.4
Total SBR			
Production	663,352	678,406	-2.2
Imports	81,933	68,577	19.5
Exports	132,127	148,492	-11.0
Apparent consumption	598,842	578,468	3.5
Total nitrile			
Production	51,940	56,986	-8.8
Imports	12,763	12,427	2.7
Exports	14,288	11,930	19.8
Apparent consumption	49,528	56,944	-13.0
Polybutadiene			
Production	311,350	303,107	2.7
Imports	50,991	59,635	-14.5
Exports	61,501	49,047	25.4
Apparent consumption	286,513	303,693	-5.7
Ethylene-propylene			
Production	196,829	198,879	-1.0
Imports	28,447	9,518	198.9
Exports	37,404	39,691	-5.8
Apparent consumption	175,899	170,766	3.0
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	498,539	509,375	-2.1
Imports	80,834	44,356	82.2
Exports	105,626	48,728	-29.0
Apparent consumption	470,883	404,351	16.4

Business Briefs

Contracts, licenses

The Sunprene Co., a joint venture company between Akron, OH-based A. Schulman and Tokyo-based Mitsubishi Kasei Vinyl began production operations at the Schulman facility in Bellevue, OH. The company will produce high performance flexible polymers for North American automakers and other industries, using Mitsubishi Kasei Vinyl's specialized technology. The Sunprene Co., owned 70 percent by Schulman, will produce 10 million pounds of polymer compounds annually, which will be distributed in the United States, Canada and Mexico. The Bellevue facility will produce Sunprene's three product lines - Sunprene, Vinika and Sunfrost.

Oliver Rubber, Oakland, CA, granted a license to Asia Tyre and Tread (ATT) of Kuala Lumpur, to manufacture and distribute pre-cure tread rubber in Malaysia. The pre-cure rubber will be manufactured at a new plant in Penang. The joint venture also involves Elgi Tyre & Tread of India. Elgi Tyre & Tread broke ground for its third pre-cure manufacturing plant in Kottai, Kerala, which will also use Oliver's technology. It is expected to open in 1990.

Exfluor Research Corp., Austin, TX, will provide certain technology for direct fluorination of ethers to 3M, St. Paul, MN, as part of a licensing agreement. Exfluor has developed capabilities for adding elemental fluorine directly to organic molecules to give high yields of fluorinated products. The technology will be used to augment 3M's range of fluorinated materials available to customers in the

rubber processing industry.

Dutch-based Akzo and U.S.-based PQ Corp. formed a joint venture, Akzo-PQ Silica, to manufacture and market certain silica-based products in Europe. The joint venture began operations January 1, 1990, with headquarters in Amersfoort, The Netherlands, and will maintain manufacturing plants in Winschoten, The Netherlands; Duren, West Germany; Vienna, Austria; and Karlstad, Sweden. Co-managing directors nominated by each partner will guide operations, and sales and marketing activities will be coordinated with those of the Akzo organization currently operating in the region.

Hoechst Celanese formed a Mexican subsidiary, Hoechst CelMex Performance Products (HCPP Mexicana) as a joint venture between Celanese Mexicana, S.A., Quimica Hoechst de Mexico, S.A., and Hoechst Celanese. The subsidiary will be responsible for the manufacture, sales and service of engineering plastics in Mexico and Central America and will receive support from compounding facilities in Xacapu, Mexico, and a technical service laboratory in San Cristobal, Mexico.

Exxon Chemical and Shell Chimie will construct a 220,000 ton/year linear low density polyethylene plant at an Exxon Chemical affiliate's site in Notre-Dame-de-Gravenchon, France. Start-up is planned for third quarter of 1991. The unit will use Unipol gas-phase technology and have high density polyethylene swing capability. A Groupement d'Interet Economique will own 50 percent, and it will be operated by Exxon's affiliate. Each company will supply its own share of ethylene and would have equal drawing rights to products. Separate marketing and product development activities will be maintained.

Baerlocher USA, a 50-50 joint venture partnership between ICC Industries' subsidiary, Dover Chemical, and Baerlocher GmbH's U.S. subsidiary, will produce liquid mixed metal PVC heat stabilizers, beginning in mid-1990. The joint venture will be based in Dover, OH. Additional plans call for construction of technical service and quality control laboratories.

GenCorp, Fairlawn, OH, and Kurashiki Kako Co. Ltd. of Kurashiki, Japan, signed a technical licensing agreement for certain vibration control parts. GenCorp will be the exclusive licensee of Kurashiki Kako's technology in North America. The agreement calls for establishment of a joint-venture sales company, GKK Automotive, in the spring of 1990. GKK will be owned 60 percent by GenCorp and 40 percent by Kurashiki Kako.

Tecbelt Pacific, a joint venture between Goodyear and Pacific Dunlop, will manufacture steel cable conveyor belting and market both steel cable and fabric conveyor belting in Australia. The joint venture will be effective beginning January 1, 1990. The companies also entered into a commercial marketing agreement through the Dunlop Industrial Group that covers the sale and marketing of power transmission products and industrial hose in Australia.

RMA tire report - September
(figures in thousands of units)

Passenger tires	YTD '89	YTD '88	% change
Shipments			
original equipment	39,748	40,147	-1.0
radial	34,693	34,216	1.4
replacement	115,368	115,717	-0.3
radial	109,590	108,216	1.3
export	9,619	7,080	35.9
radial	8,970	6,290	42.6
total	164,734	162,945	1.1
radial	153,254	148,721	3.0
Production			
radial	134,302	131,376	2.2
radial	125,457	119,541	4.9
Truck & bus tires			
Shipments			
original equipment	6,452	6,650	-3.0
radial	5,368	4,891	9.7
replacement	26,387	25,209	4.7
radial	15,682	14,740	6.4
export	2,673	2,439	9.6
radial	1,990	1,898	4.9
total	35,512	34,298	3.5
radial	23,039	21,529	7.0
Production			
radial	29,124	27,483	6.0
radial	19,498	16,897	15.4

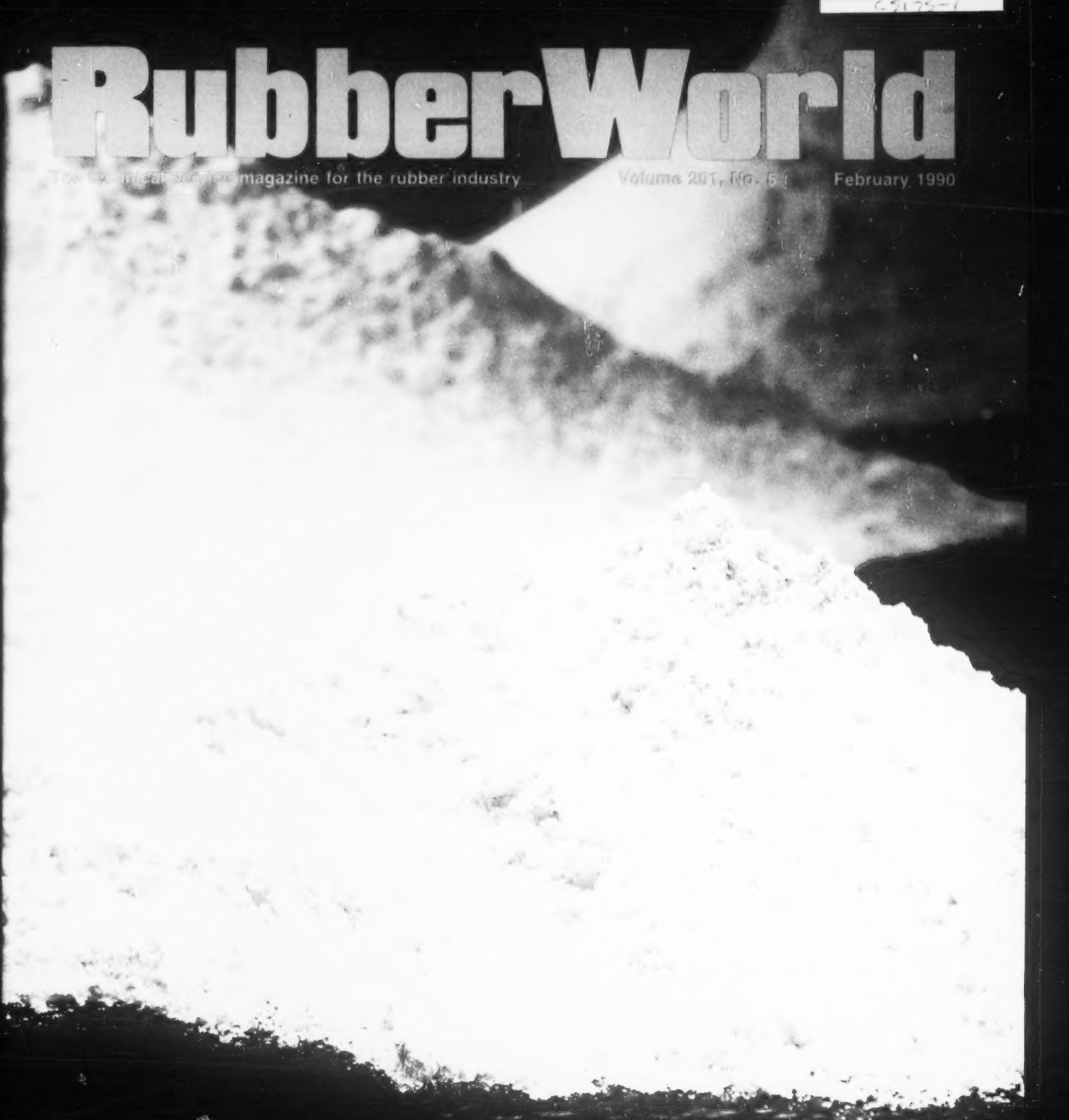
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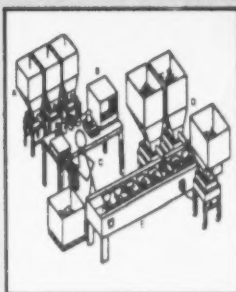
The technical services magazine for the rubber industry

Volume 201, No. 5

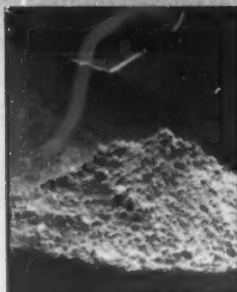
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Mixer monitoring and control
Micro weighments of ingredients
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edited by Bob Samples, Akron Rubber Development.

16 Mixing efficiency and quality: A view from a synthetic rubber producer

by P.S. Johnson, Nova/Polysar. A thorough discussion and bibliography are presented of the important factors to be controlled in achieving the fullest possible mixing efficiency and quality.

21 Internal mixer automated monitoring, control

by Kevin M. Donahue and William B. Lee, Quabaug Corp. The philosophy, mixing equipment and control system in successful use are described in detail.

26 Micro weighments of compound ingredients

by Ken Kardux, Ohaus Automated Systems. The author discusses how to achieve proper application in the plant and avoid the many pitfalls involved in the weighing of micro ingredients for rubber compounding.

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This directory of North American custom mixers of rubber and other rubber custom services suppliers includes plant locations, equipment, mixing capabilities and capacity information.

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Cover photo courtesy of Sheller-Globe.

A Lippincott & Peto Publication

 The
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Editorial

Our annual survey of the custom mixers in the rubber industry surprised us again. For the fourth straight year, the number of companies that were implementing capacity expansions was relatively high in comparison with the industry as a whole. The increases of 1987 over 1986, and 1988 over 1987, were slight in comparison to the last two years. In 1989, 42% of the North American custom mixers added to their capacity and nearly one third will add to capacity this year. It seems the main reason behind the increases is the consolidation that has taken place in the tire sector and is now spreading to the non-tire segment of the industry. Even though the tire industry has gone through intensive consolidation within the last five years, the actual tire capacity has increased. This, coupled with personnel cutbacks, streamlining of operations and other forms of restructuring, have obviously opened up more business for the custom mixer because the overall growth within the industry has been modest at best. It appears the total amount of rubber mixed has been increasing slightly, but the business to the custom mixer has been greatly increased.

This increased outsourcing of mixing has also lead to a proliferation of custom mixers. In turn, it changed the face of our annual mixing issue to include a directory of those mixers. This directory (beginning on page 33) has been set up so people can ascertain the different capabilities of companies when shopping for a custom mixer. Information is provided on what elastomers the mixer works with, the equipment used and plant capacity. We would like to say the directory includes all custom mixers in North America, but we know that's not the case. We can't force a mixer to be listed.

That's one problem you deal with in compiling directories like this. Another, which is particularly unique to this one, is in the use of registered trade names. Two of the most abused, if that's the correct word, trade names in the rubber industry are Banbury and TPR. To most in the industry, internal mixer and Banbury are synonymous. The respondents to our inquiries almost always put Banburies down for equipment used in their operations and many of these are mixers not manufactured by Farrel Corp., the only company that makes a Banbury. Farrel is very protective of the name and does not want to see it genericised. The same goes for TPR. This is a registered trade name now owned by Monsanto. It cannot be used as an acronym for thermoplastic rubber. So double check next time when you write that you mix mostly TPRs in your banburies.

Don R. Smith
Editor

RubberWorld

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Business Briefs

erlands will provide **Johnson Controls**, Manchester, MI, with the know how for recycling PET soft drink bottles in the U.S. and Canada. Johnson Controls is building a plastic container recovery center to reprocess 7,000 metric tons per year of used PET bottles, to be completed by the end of 1990. Future expansion will bring capacity up to 13,000 mt per year. PET recovered by the Reko technology is used for high-grade products.

Jaguar factory racing cars in both the United States and overseas will be equipped with **Goodyear Eagle** racing radial tires, designed and manufactured at the Goodyear Technical Center in Akron, OH, for the 1990 racing season. Both the Silk Cut Jaguar team and the Castrol Jaguar team will use Eagle racing radials.

Lescon of Flemington, NJ, has been appointed a sales agent for the vibrating needle curemeter produced by **Rapra Technology**, Shawbury, England. The VNC is an instrument used to monitor the cure of liquid polymers.

Monsanto Chemical, with networking support from **Babbage-Simmel & Assoc.**, Columbus, OH, can provide its customers with a data analysis and communication system that helps improve their rubber processing. The systems combine the power of **RheoLogic**, **MooneyLogic** and **TensiLogic** software systems with the communication flexi-

bility of computer networking. **Babbage-Simmel** specializes in computer systems, technical service and training for computer network applications.

Goldsmith & Eggleton in Akron, OH has been selected to represent **Kumho E.P. Rubber Co.**, Seoul, Korea as the North American distributor of Kumho EPDM and EPR. Goldsmith & Eggleton will also handle NBR, SBR and other polymers produced by **Korea Kumho Petrochemical Co.**

Independent chemical distributor, **Chemcentral**, headquartered in Chicago, IL, has been chosen as a distributor of **Du Pont's Hypalon CP 100** series chlorinated polyolefins. Chemcentral ready stocks the resins, and delivers LTL quantities via its own truck fleet.

Dixie Chemical, Houston, TX, appointed **Votech** a distributor for the company's line of cycloaliphatic anhydride epoxy curing agents and anhydride promoters. Votech will distribute Dixie's products in Chicago, northern Illinois, Wisconsin, northern Indiana and southwestern Michigan.

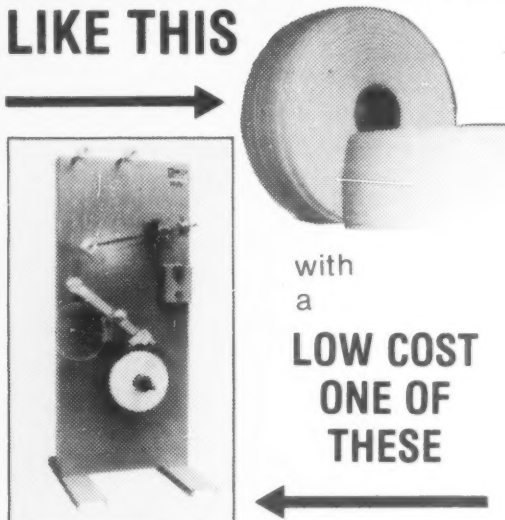
CHR Industries, New Haven, CT, appointed **Fugitt Rubber** of Memphis, TN, as a full-line distributor for its silicone rubber products, covering the vicinity of Memphis, Arkansas and Mississippi.

Polymer Industrial Products in Piney Flats, TN, manufacturers of tire curing bladders, tire building machine bladders and other custom engineered products, has appointed **Worldwide Marketing**, headquartered in Branford, CT, as exclusive sales agent for all international sales. Worldwide

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Machine Company, Inc.

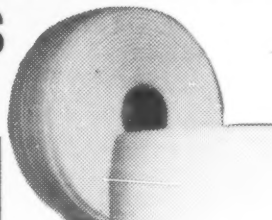
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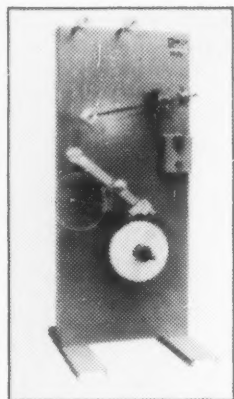
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MS104 RH

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21 Van Natta Drive, Ringwood, NJ 07456

RMA tire report - October (figures in thousands of units)			
Passenger tires	YTD '89	YTD '88	% change
Shipments			
original equipment	44,060	45,043	-2.2
radial	38,423	38,399	0.1
replacement	129,182	130,150	-0.7
radial	122,858	121,797	0.9
export	10,718	7,930	35.1
radial	10,009	7,078	41.4
total	183,958	183,122	0.5
radial	171,289	167,274	2.4
Production	149,426	147,079	1.6
radial	139,728	133,952	4.3
Truck & bus tires			
Shipments			
original equipment	7,049	7,426	-5.1
radial	5,875	5,503	6.8
replacement	29,576	28,253	4.7
radial	17,688	16,603	6.5
export	2,998	2,753	8.9
radial	2,235	2,135	4.7
total	39,623	38,432	3.1
radial	25,798	24,241	6.4
Production	32,402	30,918	4.8
radial	21,744	19,107	13.8

Custom mixing capacity increasing

North American custom mixers are still bullish on the rubber industry, according to the results of *Rubber World's* annual survey of the industry. For the fourth straight year the custom mixers overwhelmingly predicted continued growth through 1990. In anticipation of this growth, almost 33% indicated that they planned to add to capacity during the year. This is on top of the expansions that were completed in 1989 at 42% of those responding to the survey.

The survey is of 61 custom mixers in North America, with a total of approximately 3.3 billion pounds of annual capacity.

Capacity increases are planned for the following: Associated Rubber plans to bring its Huntingdon, TN plant on stream; Beebe Rubber plans to increase capacity 4% through loading efficiencies; Blair Rubber is adding a calender; Cri-Tech plans a plant debottle-necking along with extrusion

and screening improvements. They will also expand the lab by 100% and the warehouse by 50%. Douglas Polymer Mixing plans to triple its 11 million lbs./year capacity.

Dyna Mix has a new Banbury on order; Gayson is adding milling and mixing equipment; Global Processing's addition of 3 million pounds of capacity will be completed this year; Hoover-Hanes is currently installing a #15 Bolling Mixer; Martin Rubber is adding equipment; Ristance Compounds is adding an internal mixer for silicones; Techno Cautchouc is adding two No. 11 Banburys; Tristani Rubber plans to double its 7.2 million lbs./year capacity; and Valley Rubber Mixing is adding a 3D Banbury.

Capacity expansions are also slated for Alloy Polymers and Teknor Apex, but definite plans hadn't been set at the time of the survey.

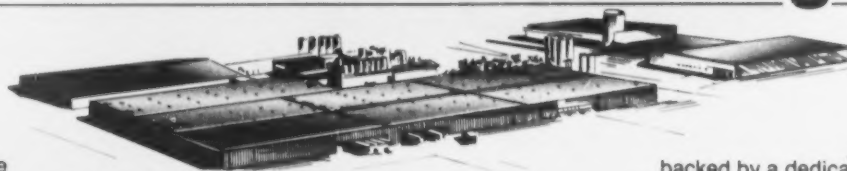
These announcements come on the heels of the expansions that took place

in 1989, one of the most aggressive years for increases since the survey was initiated seven years ago. Twenty custom mixers increased capacities in 1989. The most significant increases took place at Colonial, where they added 700 million lbs./year, Boston Industrial Products doubled capacity to 74 million lbs./year and Alloy Polymers added 25 million pounds.

Two new custom mixers began operations last year as American Silicones opened in Garrett, IN and Kardoes Custom Mixing opened in Lafayette, AL. American Silicone mixes only silicone and has an annual capacity of approximately 1.5 million pounds. Kardoes mixes NR, SBR, polybutadiene and nitrile, with a capacity of 30 million pounds.

The following pages contain a directory of custom mixers located in North America. Information is provided on the company's mixing capabilities and machinery used.

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Since 1945, the Teknor Apex Custom Rubber Mixing Division has been the main ingredient in supplying quality rubber compounds to the automotive, wire and cable, tire, consumer and industrial products markets.

Our fully automated mixing facilities with bulk black and oil handling systems in Rhode Island and Tennessee are capable of mixing most types of rubber polymers and blends. Each plant also features sophisticated laboratory facilities with state-of-the-art testing and analytical equipment.

In addition, all Teknor Apex mixed rubber products are

backed by a dedicated, experienced research and development team and a customer service department that will assure on-time delivery.

The next time you specify rubber, make sure the main ingredient is the Teknor Apex Custom Rubber Mixing Division.

For further information, contact Ron Gidlow, Sales Manager, Teknor Apex Custom Rubber Mixing Division, 505 Central Avenue, Pawtucket, RI 02861.

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Custom mixing directory

The following directory lists the custom mixers along with plant locations, equipment, mixing capabilities and capacity. A directory listing companies that offer various custom services to the rubber industry follows the directory.

AC Products, Inc.

172 E. La Jolla St.
Placentia, CA 92670
(714) 630-7311
Sheldon Weinstein, President
Hugh Muller, Vice President
Equipment: Five high speed dispersion mixers and 10 low speed mixers
Mixing capabilities: All water based and solvent soluble resins and polymers
Capacity: 2 million gals/year

Alleghany Rubber, Inc.

545 Guy Paine Rd.
P.O. Box 3006
Macon, GA 31205-3006
(912) 788-6282
Fax: (912) 781-4338
David S. O'Brien
Equipment: Banbury, mills, extruder
Mixing capabilities: SBR, NR, nitrile, EPDM
Capacity: 30 million lbs/year

Alloy Polymers, Inc.

3310 Deepwater Terminal Rd.
Richmond, VA 23234
(804) 232-8000
S. Pahuja, President
Equipment: Nine lines - Werner & Pfleiderer twin screw high intensity mixers
Mixing capabilities: Specialize in engineering polymers
Capacity: 75 million lbs/year

American Silicons Inc.

420 N. Taylor Rd.
P.O. Box 90
Garrett, IN 46738
(219) 357-6161
Fax: (219) 357-6165
Jack Cochrane & Tom Lapsley
Equipment: Dough mixers, twin-roll mills, screw extruders
Mixing capabilities: Only silicone and fluorosilicone rubber
Capacity: 1 - 1.5 million lbs/year

Associated Rubber Co.

Spring St.
P.O. Box 245
Tallapoosa, GA 30176
(404) 574-2321
Bruce George, Sales Manager
Equipment: Three #11 Banburys, 3-A Banbury, lab Banbury, three calendars, Barwell preformer, extruders
Mixing capabilities: SBR, NR, NBR, CR, ECO, CSM, EPDM, IIR, CIIR, fluoroelastomers; CPE
Capacity: 90 million lbs/year

Associated Rubber Co.,

Huntingdon Division
P.O. Box 765
Huntingdon, TN 38344
(901) 986-3689
Equipment: 1 #11 Banbury
Capacity: 30 million lbs/year

Avon Custom Mixing Services

Division of Chase Corp.
55 High St.
Hollbrook, MA 02343
(617) 767-0511
Mark F. Chase, Operations Manager
Craig Murphy, Factory Manager
Equipment: Two #11 Banburys, #3 Banbury, eight mills (84", 60", 48"), six calendars
Mixing capabilities: All elastomers including silicone; rubber & plastic custom mixing services
Capacity: 8 million lbs/year

Bata Rubber Products Division

4501 Pulaski Highway

Belcamp, MD 21017

(800) 222-8558
(301) 272-2000
James E. Vess, Director/Manager
Equipment: Banbury internal mixers and open mills
Mixing capabilities: All except fluoroelastomers; calendaring; Barwelling; straining
Capacity: 40 million lbs/year

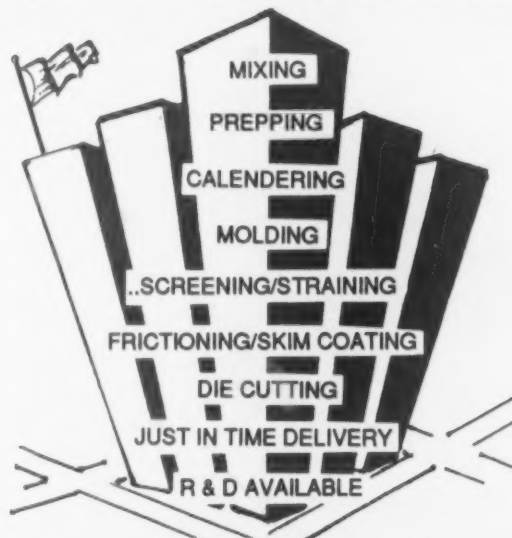
Beebe Rubber Co.

20 Marshall St.
Nashua, NH 03061
(603) 883-5576
Equipment: #3A Banbury, #11 Banbury, five mills (60" to 84")
Mixing capabilities: NR, CR, IIR, EPDM, SBR, NBR, CSM, polysulfide, all others except silicone; styrenic plastics
Capacity: 27 million lbs/year

Blair Rubber Company

P.O. Box 4284
1252 Mina Ave.
Akron, OH 44321
(216) 666-3600
Fax: (216) 666-9334
T.B. Blair, President; R.K. Lewis, V.P. Technical Director; A.W. Giles, Customer Service
Equipment: Internal mixer and open

CUSTOM COMPOUNDING & PROCESSING



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Contact Ed Buser
Division Manager

Bata Rubber Products Belcamp, MD 21017
301/272-2000 FAX 301/272- 3346

Circle 12 on card

mill, calendering, slitter, autoclaves
Mixing capabilities: Natural, nitrile, EPDM, neoprene, chlorobutyl, butyl, hypalon, SBR
Capacity: 5 million lbs/year

Boston Industrial Products Division, Dana Corp.
 Highway 77 East
 P.O. Box 38
 Newbern, TN 38059
 (901) 627-2531
 Mike Skaggs, Customer Service Mgr.
 Tom Dowdle, Sales Manager
Equipment: F270 Banbury
Mixing capabilities: NR, EPDM, SBR, NBR, CR, CSM, ECO, BR
Capacity: 74 million lbs/year

Burke Industries, Inc.
 2250 South Tenth Street
 P.O. Box 190
 San Jose, CA 95112
 (408) 297-3500
 Ray Brown, Senior Vice President
Equipment: #3, #9 and #11 Banburies, 48", 60" and 84" mills
Mixing capabilities: All types
Capacity: 36 million lbs/year

Burton Rubber Processing
 14330 Kinsman Rd.
 Burton, OH 44021
 (216) 834-4644
 James L. Cull, V.P. Sales & Mktg.

Branches
 P.O. Box 377
 Highway 34
 Jonesborough, TN 37659

10 Clearview Drive
 Tillsonburg, Ontario, Canada

Mach - 1 Compounding
 Macedonia, OH 44056
Equipment: Banburies, FCM, mills, Barwell
Mixing capabilities: All rubber.

Capacity: 200 million lbs/year
CCA Compounding
 P.O. Box 1648
 1204 E. 12th Street
 Wilmington, DE 19898
 (302) 573-2636
 P. Timothy Knaus, General Manager
Equipment: Two #4 Stewart Bolling, #10 Stewart Bolling

Mixing capabilities: Thermoplastic and elastomer blends, especially olefins, EPDM, EPR, NBR, SBR and PIB
Capacity: 55 million lbs/year

Central Rubber Co.
 844 E. Jackson St.
 Belvidere, IL 61008
 (815) 544-2191
 Bob Byczek
 Fax (815) 544-6881

Equipment: Mills
Mixing capabilities: NR, SBR, neoprene, Hypalon, nitrile, EPDM, silicone, butyl, urethane, Viton, Thiokol

Colonial Rubber Works
 150 South Connell Ave.
 Dyersburg, TN 38024
 (901) 285-4353
 Glenn Thurman, General Manager,

Branch
 P.O. Box 640
 Kingstree, SC 29556
Equipment: Rubber - Two #27 Banburies, three #12 Stewart Bolling Mixers, six #10 Stewart Bolling Mixers, five calenders (3-60", 1-96", 1-132");

Custom mixers - East

Northeast

Company	City	Equipment	Capabilities
Avon Custom Mixing	Holbrook, MA	Banburies, mills, calenders	All elastomers
Beebe Rubber Co.	Nashua, NH	Banburies, mills	All except silicone
Cri-Tech Inc.	Hingham, MA	Banburies, mills, refiners, extruders	Specialty polymers
Depco Inc.	Brentwood, NY	Mills	Exclusively silicone
Discas	Waterbury, CT	Banburies, mills, extruders, pelletizer, mixers	Thermoplastic elastomers
Dow Corning STI	Monroe, CT	Mills, extruders, mixers, testing	Silicones
J-Von	Leominster, MA	Extruders	Copolymers, elastomers
Pawling Corp.	Pawling, NY	Banburies, mills, dicer, extruders	All polymers
Pilgrim Custom Mixing	Fall River, MA	Banburies, mills, strainer	All general polymers
Quabaug Custom Mixing	N. Brookfield, MA	Banburies, extruder	Most elastomers
S & D Rubber Co.	W. Hanover, MA	Banburies, strainers, mills	All polymers
Teknor Apex Co.	Pawtucket, RI	Banburies, mixers	Most elastomers

Mid-Atlantic region

Company	City	Equipment	Capabilities
Alloy Polymers Inc.	Richmond, VA	Mixers	Engineering polymers
Bata Rubber Products	Belcamp, MD	Mixers, mills	All except fluoroelastomers
CCA Compounding	Wilmington, DE	Mixers	TPEs and elastomer blends
Dyna-Mix	Grafton, WV	Banburies	All general elastomers
Gayson Inc.	Ringwood, NJ	Banburies, mills	Specialty silicones
Passaic Rubber Co.	Wayne, NJ	Mixers, mills, calenders, extruders	All polymers
Pelmor Laboratories Inc.	Newtown, PA	Banbury, mills	All types
Polysar Rubber Services	East Brunswick, NJ	Banburies	Most elastomers
Star-Glo Ind.	East Rutherford, NJ	Mixers, calenders, mills, extruders	Most elastomers
Technical Rubber & Plastics	Clifton, NJ	Banbury	Most elastomers

Southeast

Company	City	Equipment	Capabilities
Associated Rubber Inc.	Tallapoosa, GA	Banburies, calenders, Barwell pre-former, extruders	Most elastomers
Boston Industrial Products	Newbern, TN	Banburies	Most elastomers
Burton Rubber Processing	Burton, OH	Banburies, FCM, mills, Barwell	All elastomers
Colonial Rubber Works	Dyersburg, TN	Banburies, mixers, calenders, FCM, extruders, Boss kneaders	Thermoset & thermoplastic
Hoover-Hanes	Tallapoosa, GA	Banburies, mills	All elastomers
KArdoes Custom Mixing	Lafayette, AL	Mixers, mills	Most elastomers
KTI	La Grange, GA	Banbury	Most elastomers

Thermoplastics - One #6 FCM, two #9 FCMs, one #15 FCM, one - 36:1, 6" extruder, two - 140mm Boss Kneaders, and two #2 Stewart Bollings
Mixing capabilities: Thermoset and thermoplastic
Capacity: 1 billion lbs/year

Cri-Tech, Inc.
 150 Recreation Park Dr.
 Hingham, MA 02043
 (617) 740-2020
 Richard Mastromatteo, President
 Woodford Garrigus, Technical Service
Equipment: Three #3 Banburies, two

84" mills, three 60" mills, 40" mill, two refiners, 10", 8", 6" and 4" extruders
Mixing capabilities: Specialty polymers including fluoroelastomer, fluoro-silicone and silicone; specification compounding to meet ASTM, SAE, and Military requirements to FKM & FVMQ & Special alloys of FKM offered
Capacity: 7.5 million lbs/year

Depco Inc.
 36 Grand Blvd.
 Brentwood, NY 11717
 (516) 231-1610
 David Bean, President

Equipment: Two mills (40" and 45")
Mixing capabilities: Exclusively silicone
Capacity: One million lbs/year

Disca
 56 Eagle Street
 P.O. Box 2068
 Waterbury, CT 06708
 (203) 755-5755
 Dennis J. Synnott, Director, Market Development
Equipment: #9 Banbury, 60" mill, 40" mill, three lab mills, lab Banbury, 6", 3-1/2", 2-1/2" and 1-1/2" extruders, underwater pelletizer, Henschel mixer
Mixing capabilities: Thermoplastic elastomers
Capacity: Not available

Douglas Polymer Mixing Corp.
 30 2nd St., S.W.
 Barberton, OH 44203
 (216) 753-6900
 Bernie Wurts, Manager, Production Planning
 Nolan Douglas, President
Equipment: #3 to #27 Banburies and various mills
Mixing capabilities: All polymeric type compounds, compounding design
Capacity: 11 million lbs/year

Dow Corning STI
 Corporate Headquarters
 47799 Halyard Dr.
 Suite 99
 Plymouth, MI 48170
 (313) 459-7792
 S.F. Long, President
 J.A. Hickey, Ex. Vice President of Operations
 J.W. Carroll, V.P. Marketing/Sales
Capacity: 30 million lbs/year

Eastern Region
 594 Pepper St.
 Monroe, CT 06468
 (203) 452-9199
 Charles Romig, V.P. General Mgr.
 M. Furlo, Plant Mgr.
 R. Wilson, Sales Mgr.
Equipment: Mills, extruders, dough-mixers, full lab mixing, testing
Mixing capabilities: Silicones, fluoro-silicones, color masterbatches
Capacity: 8 million lbs/year

Midwestern Region
 U.S. 6 Hwy. - East
 Kendalville, IN 46755
 (219) 347-5813
 Ross Shingledecker, V.P. Gen'l Mgr.;
 Ron Romanowski, Tech Service Mgr.
 Mary Lou D'Alessandro, Sales Mgr.
Equipment: Mills, extruders, dough-mixers, development lab
Mixing Capabilities: Silicones, fluoro-silicones, color masterbatches
Capacity: 18 million lbs/year

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- TER-Polymer Compounds for extra chemical resistance



Eagle
 ELASTOMER Inc.

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 Cuyahoga Falls, Ohio 44223

(216) 923-7070
 FAX (216) 923-4005

(listing continued on next page)

Western Region
20832 Currier Rd.
Walnut, CA 91789
(714) 595-6331

D. Closs, Vice President/G.M.

B. Jones, Plant Manager

R. Tanton, Sales Manager

Equipment: mills, extruders, dough-mixers, full lab

Mixing capabilities: Silicones, fluoro-silicones, color masterbatches

Capacity: 4 million lbs/year

Dyna-Mix Custom

Mixed Rubber

P.O. Box 369

Country Club Road

Grafton, WV 26354

Marlowe N. Christopher, Vice President/Sales; Lynn Nye, Technical Mgr.

(800) 255-2681

(304) 265-5100 (in WV)

Equipment: #11 Banbury

Mixing capabilities: All general purpose elastomers

Eagle Elastomers

338 Remington Rd.

Cuyahoga Falls, OH 44224

(216) 923-7070

Neil McHale, Director of Sales

Equipment: 36" special mill, 60" mill, 60" calender, 2-1/2" extruder, 3-1/2"

extruder, 42" x 42" press

Mixing capabilities: Fluoroelastomers

Capacity: 2.50 million lbs/year

Elastomer Processing Corp.

2448 West 24th Street

Chicago, IL 60608

(312) 254-4039

Fax: (312) 254-6768

Merle Owen, Director of Sales

Equipment: #9 Banbury, #3 Banbury,

84" mill, two 60" mills, 48" mill, 60" calender, 36" calender, extruder

Mixing capabilities: All types excluding silicone

Capacity: 7 million lbs/year

Fluorocarbon/PRP Division

12257 FM 529

P.O. Box 3402

Houston, TX 77253

(713) 466-4365

Tom Turner, Sales Manager

Equipment: Banbury and open mill

Mixing capabilities: Nitriles, neoprenes, fluoroelastomers, Aflas, natural rubber, EPDM and silicones

Gayson, Inc.

P.O. Box 222

Ringwood, NJ 07456

(201) 728-8100

L. Raymond Olson, President

Equipment: Banbury, two 2-roll mills, three 3-roll mills

Mixing capabilities: Silicone, specialty colors; custom compounding of colors for silicones

Global Processing Co.

11831 Wakeman St.

Santa Fe Springs, CA 90670

(213) 945-1241

Fax: (213) 698-7818

Fred Williams, President

Equipment: Two - #4 Stewart Bolling mixers, two-60" mills, 1-42" mill and 1 - 50" mill

Mixing capabilities: All types except silicone, specialize in fluoroelastomers

Capacity: 8 million lbs/year

GLS-Plastics

1066 Dieckman Rd.

Woodstock, IL 60098

(815) 338-8662

Michelle Woodham, Marketing Assistant

Equipment: Banbury, extruders, high intensity mixers and Lowes dissolver

Mixing capabilities: Thermoplastics

Graphic Arts Rubber, Inc.

467 Dan Street

Akron, OH 44310

(216) 253-0731

Glen Hoffman, Sales Manager

Gayson

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(201) 728-8100

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- Mill mixing
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**Graphic arts
rubber, inc.**

467 Dan St. • Akron, Ohio 44310 • (216) 253-0731

Circle 15 on card

Circle 16 on card

Equipment: Three 60" mills, two 3-roll cloth calenders
Mixing capabilities: All-no free black; custom calendering - custom mixing
Capacity: 3 million lbs/year

Hoover-Hanes
Pequanoc Dr.
Tallapoosa, GA 30176
(404) 574-2341
Jack Williams, Vice President and General Manager
Equipment: #270 Banbury, #12 Banbury, #9 Banbury, 84" mill, 100" mill
Mixing capabilities: All grades of soft and hard rubber
Capacity: 58 million lbs/year

J-Von
25 Litchfield St.
Leominster, MA 01453
(508) 537-4721
Daniel Hunter, General Manager
Equipment: 2-1/2" single screw extruder, 4-1/2" single screw extruder, 67mm twin screw extruder and 110mm twin screw extruder
Mixing capabilities: Styrenic block copolymers, thermoplastic elastomers
Capacity: 21 million lbs/year

Kardoes Rubber Co.
P.O. Box 350

LaFayette, AL 36862
(205) 864-0777
Fax: (205) 864-0776
H. Frank Kardoes
Equipment: 5-268 mixer
Mixing capabilities: Natural rubber, styrene butadiene rubber, polybutadiene, nitrile
Capacity: 30 million lbs/year

Kleen-Tex Inc.
Plant III, Orchard Hill Rd.
P.O. Box KTI
La Grange, GA 30241
(404) 882-8134
800-241-2323
Fax: (404) 884-6378
John R. Smith, Division Manager
Equipment: S-268 mixer
Mixing capabilities: Nitrile, SBR, PBD, natural, EPDM, chlorobutyl
Capacity: 24 million lbs/year

Laur Silicone Rubber Compounding, Inc.
4930 S. M-18
P.O. Box 509
Beaverton, MI 48612
(517) 435-7706
Dan Laur, Vice President
Equipment: 24" mill, 60" mill, 10 gal. and 150 gal. double arm mixers, pre-

forming strainers
Mixing capabilities: Exclusively silicone rubber
Capacity: One million lbs/year

Mach-1 Compounding
775 E. Highland Rd.
Macedonia, OH 44056
(216) 467-8109
Edward M. Echan, Vice President, Plastic Compounding Operations; Rob Dirienzo, Sales Manager
Equipment: #3D Banbury, Henschel, ribbon blender, F80 Banbury, #4 FCM
Mixing capabilities: Thermoplastic, thermoset, thermoplastic elastomer, alloys, fluoroelastomers, slabs, strips or pellets
Capacity: 35 million lbs/year

Martin Rubber Co. of Ohio
9976 Rittman Road
Wadsworth, OH 44281
(216) 336-6604
T.O. Martin, Jr., President
Equipment: 3A Banbury, four 60" mills, one 60" calender, one 54" calender, one cameron slitter
Mixing capabilities: All types except silicone and Viton; custom calendering, mixing, and slitting
Capacity: 5 million lbs/year

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1-800-241-2323
GA 404/882-8134
FAX: 404/884-6378
Ask For John R. Smith, Div. Manager
KLEEN-TEX, INC.
P.O. BOX KTI, LaGrange, GA 30241

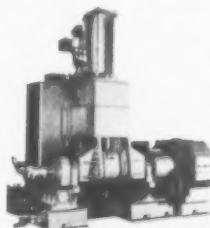
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Bayamon, P.R. 00619

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FAX (809) 740-3965

Circle 18 on card

Master Processing Corp.
2500 Thompson St.
P.O. Box 740
Long Beach, CA 90801
(213) 531-3880
L.G. Parasson, Sales & Marketing
Branch
Muscataine, IA
(319) 262-2505

Equipment: Two 8" strainers, rubber refiner, #11 Banbury, three #12 Stewart Bolling, #10 Stewart Bolling, three 66" calenders, 60" calender, seven mills (60", 66", 84"), fabric slitter
Mixing capabilities: All of the solids
Capacity: 125 million lbs/year

**Midwest Rubber
Custom Mixing Division**
745 Norton Ave.
P.O. Box 270
Barberton, OH 44203
(216) 753-5056
Gerry Weigand, General Manager
Equipment: #11 Banbury, Shaw K-7, #12 Stewart Bolling
Mixing capabilities: Standard types
Capacity: 60 million lbs/year

Oliver Rubber, Flexmix Division
6840 Forrest Park Rd.
Dallas, TX 75235
(214) 350-7851

Fax: (214) 350-6281
(800) 346-5928
Dan Warner, Sales Mgr. - Flexmix; Lori Peterson, Sales Assistant
Equipment: Multiple Banburies, mills, extruders, calenders and slitters

Paeco Rubber Div. of Akro Corp.
225 W. Lake St.
P.O. Box 472
Ravenna, OH 44266
(216) 256-9691
(216) 673-4100
James E. Roscoe, Plant Manager; Joel Donnerwirth, Tech Sales Mgr.
Equipment: #10 Stewart Bolling
Mixing capabilities: All except specialty rubbers or thermoplastics
Capacity: 20 million lbs/year

Passaic Rubber Co.
45 Demarest Dr.
P.O. Box 505
Wayne, NJ 07474-0505
(201) 696-9500
Fax: (201) 696-0686
John Mathey or Jeff Leach
Equipment: #4 Stewart Bolling, five mills (60" to 84"), two 54" calenders, 4" extruder
Mixing capabilities: All polymers
Capacity: 5 million lbs/year

Pawling Corp.
157 Charles Colman Boulevard
Pawling, NY 12564-1188
(914) 855-1000
Maurice V. Smith, Vice President and Technical Director
Equipment: Two #11 Banburies, #3 Banbury, two 84" mills, 60" mill, 48" mill, dicer, three strainer/extruders; complete laboratory & testing facilities
Mixing capabilities: Natural and synthetic polymers including silicone
Capacity: 40 million lbs/year
Pelmor Laboratories Inc.
401 Lafayette St.
Newtown, PA 18940
(215) 968-3334
Equipment: #1B Banbury, three mills (18", 40", 60")
Mixing capabilities: Generally all types, specializing in Viton
Capacity: 500,000 lbs/year

Pilgrim Custom Mixing
84 Water St.
Fall River, MA 02722
(508) 675-0181
Ext. 318-322
John P. Davis, Manager
Joseph A. Davis, Manager
Equipment: Three #11 Banburies, two 60" mills, three 84" mills, strainer
Mixing capabilities: All general pur-

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- Calhac, Honda Preferred Supplier

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RUBBER
DIVISION**

P.O. Box 472, 225 West Lake Street, Ravenna, Ohio 44266 (216) 673-4100

Custom Mixing

SERVICE TO THE RUBBER INDUSTRY



Polymeric, Inc.

2828 Second Street, Cuyahoga Falls, OH 44221
216-928-2210

Circle 19 on card

Circle 20 on card

Custom mixers - Ohio

Company	City	Equipment	Capabilities
Blair Rubber Co.	Akron, OH	Mixer, mills calendaring	Most elastomers
Burton Rubber Processing	Burton, OH	Banburies, FCM, mills, Barwell	All rubbers
Douglas Polymer	Barberton, OH	Banburies, mills	All polymeric compounds
Eagle Elastomers	Cuyahoga Falls, OH	Mills, calendars, extruders	Fluoroelastomers
Graphic Arts Rubber Inc.	Akron, OH	Mills, calendars	All-no free black,
Mach-1 Compounding	Macedonia, OH	Banburies, blenders, FCM	Most elastomers
Martin Rubber Co. of Ohio	Wadsworth, OH	Banburies, mills, calendars	All except silicone and Viton
Midwest Rubber	Barberton, OH	Banburies, Shaw mixer	Standard types
Paeco Rubber Div. of Akro	Ravenna, OH	Mixers	All except specialties
Polymeric Inc.	Cuyahoga Falls, OH	Banburies, mills, extruder	Most elastomers
Polysar Rubber Services	Akron, OH	Banburies	Most elastomers
Rainbow Mastermixing Inc.	Akron, OH	Mills, granulators	All types
Rauh Rubber Inc.	Akron, OH	Banburies, mills, Barwell, extruder/	Most elastomers
Rubber Mixing Ind.	Wooster, OH	Banburies, calendars	Most elastomers
Valley Rubber Mixing Corp.	Copley, OH	Mills, mixers	All polymers

pose polymers

Capacity: 13 million lbs/year

Polymeric, Inc.

2828 Second St.
Cuyahoga Falls, OH 44221
(216) 928-2210

Dave Topliff, General Manager

Equipment: #9 Banbury, 60" mill, 84" mill, extruder

Capacity: 12 million lbs/year

Polysar Rubber Services

2603 W. Market St.
Akron, OH 44313

(216) 836-0451

T.C. Green, Vice President and G.M.
R.W. Houkom, G.M., Silicones
D.J. Kraus, Manufacturing Manager

Regional Plant Locations:

1020 Lambert St.
Barberton, OH 44203
(216) 745-1184
N. Griffin, Site Manager

Colonial Oaks Industrial Park
P.O. Box 327
East Brunswick, NJ 08816
(201) 257-9600
A.T. Lipsky, Site Manager

1038 Evans Ave.
Akron, OH 44305
(216) 630-9460
Ray Brabson, Site Manager
Equipment: Two #4 Banburies, two #11 Banburies, #12 Banbury, two F270 Banburies
Mixing capabilities: Most organic rubbers and thermoplastics, silicone, separate black and non-black facilities
Capacity: Approximately 100 million lbs/year

Quabaug Custom Mixing
North Brookfield, MA 01535
(800) 325-5022
(617) 867-7731
Kevin Donahue

Equipment: Two Banburies, one #9 Banbury, two lab Banburies, extruder/strainer
Mixing capabilities: SBR, neoprene, nitrile, butyl, EPDM, hydrins
Capacity: 50 million lbs/year

R&S Processing Co., Inc.
15712 Illinois Ave.
P.O. Box 2037
Paramount, CA 90723

(213) 531-1403

James Inga, President

Equipment: #9 Banbury (black), #4 Stewart Bolling (colors)

Mixing capabilities: NR, IR, SBR, IIR, EPDM, ECO, CR, urethane, fluoroelastomers, NBR

Capacity: 18 million lbs/year

Rainbow Mastermixing Inc.

455 Dan St.
Akron, OH 44310
(216) 374-1810

Daniel R. Unk, President
Equipment: 60" rubber mills, granulators, 42" rubber mill
Mixing capabilities: All types, specializing in colors and fluoroelastomers
Capacity: 2 million lbs/year

Rauh Rubber Inc.
1310 DeValera Ave.
Akron, OH 44310
(216) 633-4282

Joe Rauh, President

Equipment: #11 Banbury, 60" mill, 84" mill, Barwell extruder/preformer, 3A Banbury, two 48" mills, rheometer, BR Banbury, lab mill
Mixing capabilities: NR, SBR, EPDM, NBR, CR, EPR, IIR, ECO, TPE
Capacity: 20-30 million lbs/year

Ristance Compounds

14155 Esther Ave.
Mishawaka, IN 46545
(219) 259-9903
Equipment: mills, extruders, high intensity mixer
Mixing capabilities: Silicone, PVC

Rubber Mixing Industries

1205 E. Bowman St.
Wooster, OH 44691
(216) 264-4091
E. David Gordon
Equipment: #3A Banbury, #11 Banbury, 68" 3-roll calender, 66" 3-roll calender, 78" 4-roll offset calender
Mixing capabilities: NBR, SBR,



CUSTOM MIXING WHERE QUALITY IS ESSENTIAL!

- Open mill mixing
- Specializing in short runs
- Colors or black
- Formulation and compound development
- Fully computerized laboratory
- Dispersions - standard or custom made

CUSTOM CALENDERING

Valley RUBBER MIXING 3261 Copley Road
Copley, Ohio 44321
(216) 668-6513

Circle 21 on card

Custom mixers - Midwest

Company	City	Equipment	Capabilities
American Silicones	Garrett, IN	Mixers, mills, extruders	Silicones
Burton Rubber Processing	Tillsonburg, Ont.	Banburies, FCM, mills, Barwell	All elastomers
Central Rubber Co.	Belvidere, IL	Mills	Most elastomers
Dow Corning STI	Kendallville, IN	Mills, extruders, mixers	Silicones
Elastomer Processing	Chicago, IL	Banburies, mills, calenders, extruders	All types except silicone
GLS Plastics	Woodstock, IL	Banburies, extruders, mixers,	Thermoplastics
Laur Silicone	Beaverton, MI	Mills, mixers, strainers	Exclusively silicone
Ristance Compounds	Mishawaka, IN	Mills, extruders, mixers	Silicone, PVC
Uniroyal Plastics Co.	Mishawaka, IN	Banburies, mills, mixers	All synthetics

EPDM, CSM, CR, IIR, custom calendaring

Capacity: 35-40 million lbs/year

S&D Rubber Co.

King Street

W. Hanover, MA 02339

(617) 878-2626

John P. Davis, Manager

Joseph A. Davis, Manager

Equipment: Three #9 Banburies, two strainers (4" and 8"), two mix mills (60" and 84")

Mixing capabilities: All polymers

Capacity: 15 million lbs/year

Star-Glo Industries

2 Carlton Ave.

East Rutherford, NJ 07073

(201) 939-6162

E. Peterhoff, General Manager

Equipment: Two #3A Banburies, two 66" calenders, eight mills, six extruders
Mixing capabilities: NR, SBR, CIS-BR, NBR, CR, IIR, EPDM, CSM, ACM, urethane, Norsorex, fluoroelastomers, silicone;

Capacity: 2 million lbs/year

Technical Rubber & Plastics

180 Getty Ave.

Clifton, NJ 07015

(201) 546-0700

Marc Witt, Vice President

Equipment: #3A Banbury

Mixing capabilities: Most elastomers

Techno Caoutchouc Inc.

C.P. 4180-468 St. Roch Nord

Rock Forest, Quebec J1N 1E2

Equipment: Banburies

Mixing capabilities: Most elastomers

Capacity: 20 million lbs/year

Teknor Apex Company

Pawtucket, R.I. 02861

(401) 725-8000

Fax: (401) 725-8095

Ron Gidlow, Custom Rubber Mixing;

Lew Green, Thermoplastic elastomers

Equipment: Banburies; internal mixers

Mixing capabilities: Most elastomers

Tristani Rubber Industries

Box 1051

Sabana Seca, Puerto Rico 00749

(809) 798-3131

Fax: (809) 740-3965

John T. Sherwood

Mixing capabilities: Most elastomers

Capacity: 7.2 million lbs/year

Uniroyal Plastics Company

Elastomeric Products Division

312 North Hill Street

P.O. Box 2000

Mishawaka, IN 46544-1399

(219) 256-8360

Richard Hupp - National Sales Mgr.

Equipment: Banbury, open mill and internal mixer

Mixing capabilities: All natural and synthetic; compounding; calendaring; extruding

Capacity: 200 million lbs/year

Valley Processing

491 Wilson Way

Industry, CA 91744

(818) 961-0311

Sy Hasan, Vice President, Sales

Equipment: #11 Banbury, two #12 Stewart Bollings, #4 Stewart Bolling, #3A Banbury, BR lab Banbury, 66" 4-roll fabric calender, 60" 3-roll gum calender

Mixing capabilities: All organic elastomers, black and colors

Capacity: 112 million lbs/year

Valley Rubber Mixing, Inc.

3261 Copley Road

Copley, OH 44321

(216) 668-6513

James A. Berresford, president

Jack L. Reilly, Vice President

Equipment: Open mill, high intensity mixer to 1,000 lb. batch size

Mixing capabilities: All polymers, all colors, most blacks

Capacity: 2.5 million lbs/year

Hermann Weber & Co., Inc.

103 East Front Street

Red Bank, NJ 07701

(201) 530-2100

Jeffrey Herring, President

Services offered: Rubber calendaring, milling; mixing

West American Rubber Co.

750 North Main St.

Orange, CA 92668

(714) 532-3355

Paul Colton, Vice President, Technical Services

Equipment: #3A and #11 Banburies

Mixing Capabilities: All solid polymers

Capacity: 24 million lbs/year

Custom Services

ACM Corporation

117 Industrial Road

Summerville, SC 29483

(803) 821-1888

Rick Moore, President

Services: Granulating and grinding of vulcanized and unvulcanized polymers from 1" down to 100 mesh

Equipment: Grinders - ambient and

CRUMB RUBBER

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CUSTOM GRINDING

ALL TYPES
AND SIZES

SPARTON

ENTERPRISES, INC.



Phone: (216) 745-6088

FAX: (216) 745-5862

3717 CLARK MILL ROAD
BARBERTON, OH 44203 USA

Circle 22 on card

Custom mixers - Southwest, West

<i>Company</i>	<i>City</i>	<i>Equipment</i>	<i>Capabilities</i>
Fluorocarbon/PRP AC Products Inc. Burke Industries Inc. Dow Corning STI Global Processing Master Processing	Houston, TX Placentia, CA San Jose, CA Walnut CA Santa Fe Springs, CA Long Beach, CA	Banbury, mill Mixers Banburies, mills Mills, extruders, mixers Mixers, mills Strainers, refiner, Banburies, mixers calenders, mills Banbury, mixer Banburies, mixers, calenders Banburies	Most elastomers Resins, polymers All types Silicones All types except silicone All solids
R & S Processing Valley Processing West American Rubber.	Paramount, CA Industry, CA Orange, CA		Most elastomers All organic elastomers All solid polymers

cryogenic, granulators, bale granulators and grinders, and sizing equipment

Akron Dispersions, Inc.

3291 Sawmill Road

P.O. Box 4295

Akron, OH 44321

(216) 666-0045

Michael J. Giustino, President

Jeanne Volk, Customer Service

Services offered: Chemical grinding and blending, rubber grinding, DLCs, liquid blending

Baker Rubber, Inc.

P.O. Box 2438

South Bend, IN 46680

(219) 291-5101

Fax: (219) 291-5101

William E. Stoler, Sales Manager

Services offered: Grinding of tires, buffings, tread rubber, SBR, EPDM and neoprene

Equipment: Grinders and choppers; vibrating screens

Calendering Specialists, Inc.

1119 Commercial Blvd., South

Arlington, TX 76017

(817) 467-1200

Don Ripley, Vice President, Production Manager

Services offered: Custom calendering

Equipment: Calender, 66" mills, slitters, dip tanks

The Crislip Corporation

121 Factory Street

P.O. Box 4441

Creston, OH 44217

(216) 435-6381

D.E. Crislip, Jr., President

Services offered: Tank lining and tank lining applicator rubber

Equipment: Mills, calenders, autoclaves, presses, air compressors, steam tables, lathes

Entropex

1390 Lougar Ave.

Sarnia, Ontario, Canada N7S 5N7

(519) 332-0430

Derek Smith, President

Services offered: Dewatering, reprocessing

North American Reiss Corp.

1 Polymer Place

P.O. Box 72

Blackstone, VA 23824

(804) 292-1600

Harry V. Newton, General Manager

Services offered: Silicone rubber compounds

Equipment: Rubber internal mixer, mills and extruders for straining and preforming

Procex Inc.

880 Cherry St.

Kent, OH 44240

(216) 673-1114

Fax: (216) 673-1115

Hank Wornoff

Services offered: Metal reclaiming - removing bonding agent, rubber and urethane from rubber-to-metal parts

Equipment: proprietary

E.L. Puskas Company

448 E. South St.

P.O. Box 229

Akron, OH 44309

(216) 376-5161

Ernest L. Puskas, Sr., President

Services offered: Grinding, mixing and color matching

Salem-Republic Rubber Co.

P.O. Box 389

475 W. California Ave.

Sebring, OH 44672

(800) 221-5389, U.S.A.

(800) 686-4199, Ohio

Fax: (216) 938-9809

A.V. Ney, President, General Manager

Equipment: Processing machinery and equipment, mills, extruders, calenders, cutting equipment, dryers, lathes, vulcanizers, autoclaves

Services offered: Hand and machine-made hose, custom calendered uncured materials

Capacity: custom calendered goods - 750,000 lbs/year

Sparton Enterprises, Inc.

3717 Clark Mill Road

Barberton, OH 44203

(216) 745-6088

James Little Jr. President;

Joseph Krunich, Sales

Equipment: Grinders, granulators, sifters and sizing equipment

Services offered: Rubber grinding, granulating, recycling

Capacity: 90 million lbs/year

Tooltec Inc.

2225 Meyer Road

Fort Wayne, IN 46803

(219) 426-4686

Karl Reuther II, President

Services offered: Manufacturing of trimless rubber mold; compression molds and injection molds

Equipment: Two CNC lathes, two CNC vertical machining centers, seven engine lathes, four Bridgeport mills, two radial drills, grinders

Note: Banbury, Barwell, Stewart Belling, Henschel are registered trademarks

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RubberWorld

The technical service magazine for the rubber industry

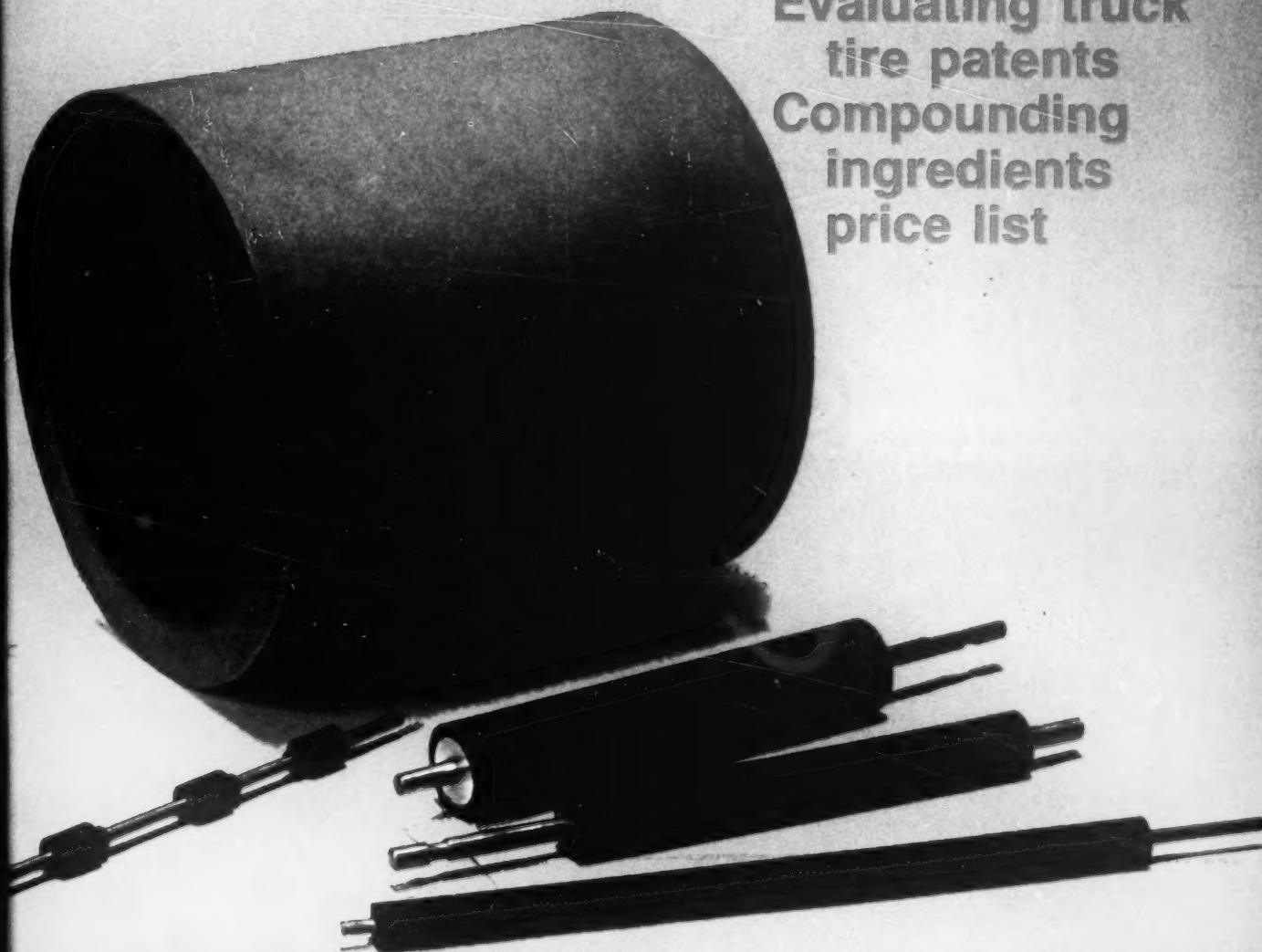
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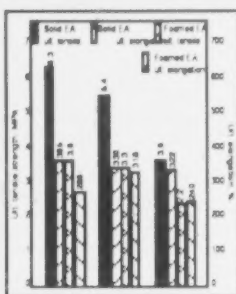
March 1990

New foamed elastomeric alloys

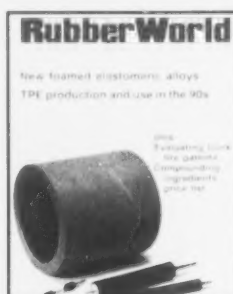
TPE production and use in the 90s

plus:
Evaluating truck
tire patents
Compounding
ingredients
price list

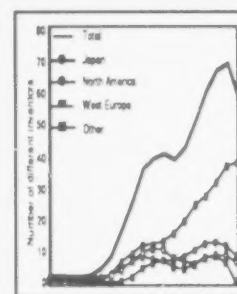




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Cover photo courtesy of Monsanto Chemical.

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The Audit Bureau

Editorial

The evolution of thermoplastic elastomers in the rubber marketplace has been interesting to observe. Although it's been almost 40 years since the introduction of the first styrenic thermoplastic elastomers, TPEs are considered a new class of material by many. This is due in part to an increase in development of new TPEs within the past several years and to the marketing of the new TPEs. With the introduction of a number of new TPEs in the 1980s came aggressive marketing to find applications. Faster cycle times, colorability, no scrap and lower finished part costs were just some of the advantages. Throw in lower density and finished product uniformity and you have a product ideal for the automotive applications of elastomers the producers claimed.

The problem was, they didn't have anybody to process it and few applications called for TPEs. Rubber product manufacturers shied away because it wasn't requested by the customer and it required an investment in new equipment. Plastics processors had the equipment but weren't selling to the markets suitable for TPE applications. The TPE suppliers then turned their attention on convincing the end user and the strategy seems to have paid off. The automotive industry naturally was the first target along with the construction market and the results look more than favorable for both the suppliers and the product manufacturers who have invested in TPE equipment. The article "TPE production and use in the 1990s" by Rudy School of R.T. Vanderbilt focuses on the expected growth of TPEs for this decade. School examines these markets and other TPE applications in his article beginning on page 15. In "New foamed EAs and other technologies," authors P.D. Agrawal and K.E. Kear of Monsanto present some specific new applications for TPEs. These deal with foamed elastomeric alloys for foamed rubber applications, roll covers and sound attenuation. As can be seen from these articles, TPEs are no longer novelties.

Another item that is no longer a novelty is pointing out some reasons for the success of Japanese companies. In the article "Evaluating truck tire patents," authors Dunn, Henderson and Smirle of Nova/Polysar show trends using computer assisted patent analysis. Although the information derived is intended to show what needs manufacturers will have it also points out where the real activity lies based on patent applications in the truck tire area. It is also a confirmation of priority placed on R&D worldwide.

Don R. Smith
Editor

RubberWorld

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Business Briefs

uct developed is Triax CBE/1, a flame retardant alloy to be marketed by Monsanto.

UCB Chemicals and JSR (Japan Synthetic Rubber) in Tokyo have entered into an agreement for the joint development of the technology and know-how belonging to the two partners in the field of specialty chemicals for electronics. Terms of the agreement call for JSR to purchase 50 percent of the shares of UCB Electronics S.A. UCB Electronics' production units and application laboratories in Haasrode and Drogenbos, Belgium will be expanded. The joint venture will establish a U.S. subsidiary in the first half of the year, followed by construction of a \$10 million production and technical service unit later in the year.

EMS-Chemie AG of Domat/Ems, Switzerland formed a joint venture with UBE Industries, Tokyo, to produce lactam-12 in Japan. UBE-EMS Ltd. will build a plant with an annual capacity of 33 million pounds in Ube City, Japan. Start-up is scheduled for 1992. UBE will hold a 51% share, and EMS a 49% share.

Quadrax, headquartered in Portsmouth, RI, signed a definitive agreement with Hexcel, headquartered in Dublin, CA, to develop, manufacture and market cored structural composite panels for aerospace, naval and rail markets. The panels are made by combining a core of Hexcel metallic or non-metallic honeycomb with a facing of Quadrax's composite thermoplastic prepreg fabrics, and will be manufactured and marketed by Hexcel when commercialized. The companies will jointly work to develop new suitable bonding technology.

Polymer Transfer Services, Houston, TX, a wholly-owned subsidiary of Shuman Plastics, will warehouse and distribute Shuman's line of Dyna-Purge purging compounds for the cleaning of plastic processing machines.

Corporate, financial news

ACM's ownership has been consolidated from three partners to two. The company repurchased the shares of Bo Adamson, who was president, and appointed Philip Comenos chairman of the board and Richard C. Moore Jr. president. Adamson will remain associated with ACM, located in Summerville, SC, through a five year marketing consulting agreement.

A management group led by Thomas Marshall, chairman of the board and chief executive officer of Aristech Chemical, proposed a management-led acquisition of the company in association with Mitsubishi at \$26 cash per share for all common shares of stock outstanding. Commitments for financing have been arranged, and the proposal is subject to completion of definitive agreements, governmental consents and approvals.

Bridgestone/Firestone will combine the 85 salaried employees of the Firestone office in Hamilton, Ontario, with 65 corporate employees of Bridgestone (Canada), located in Mississauga, Ontario, where the combined company,

Bridgestone/Firestone Canada will be located. Separate brand identity will be maintained for Bridgestone, Firestone and Dayton tires, the company reported.

Bridgestone/Firestone will combine the operations of Firestone Singapore Private Ltd. with those of the Singapore branch office of Bridgestone. The resulting company, Bridgestone/Firestone Singapore Pte., Ltd., will unify Bridgestone's worldwide natural rubber purchasing operations, and will employ more than 20 people. Bridgestone's Singapore office will remain open through June to finish outstanding business.

Du Pont increased the price of neoprene synthetic rubber in North America by 8 cents per pound, effective February 1. The hike, 4 to 6 percent for all grades of dry and latex neoprene, is attributable to cost increases.

Engelhard said it will sell certain businesses as part of a major restructuring plan. The businesses to be sold include its metal joining and crystals, and electronics operations. The company will also restructure ongoing operations, and anticipates reduction of about 500 salaried jobs, in an effort to reduce its annual operating expenses by \$30 million or more.

Firestone Industrial Products will phase out production of custom molded goods at its plant in Noblesville, IN, by August, and instead will focus on production of air springs for use in the transportation and manufacturing industries. The company will consolidate and move production of heavy duty air springs into the remaining manufac-

RMA tire report - November
(figures in thousands of units)

Passenger tires	YTD '89	YTD '88	% change
Shipments			
original equipment	48,153	49,863	-3.4
radial	42,009	42,552	-1.3
replacement	142,062	143,255	-0.8
radial	135,317	134,166	0.9
export	11,621	8,655	34.3
radial	10,849	7,736	40.2
total	201,836	201,773	-
radial	188,175	184,453	2.0
Production	162,859	161,228	1.0
radial	152,576	147,082	3.7
Truck & bus tires			
Shipments			
original equipment	7,662	8,135	-5.8
radial	6,394	6,090	5.0
replacement	32,707	31,250	4.7
radial	19,636	18,477	6.3
export	3,299	3,017	9.4
radial	2,461	2,344	5.0
total	43,668	42,403	3.0
radial	28,492	26,910	5.9
Production	35,292	34,022	3.7
radial	23,756	21,112	12.5

Business Briefs

turing space at the Noblesville site. The current work force of 520 hourly and 230 salaried will be reduced by about 200 and 50 respectively. The corporate headquarters staff of about 40 will be relocated from the plant complex to a location yet to be determined, but reported to be somewhere near Indianapolis.

Goodyear will cut back production of bias light truck tires, specialty tires and some bias medium truck tires, about 6,000 tires per day overall, at its Gadsden, AL plant, affecting 500 salaried and hourly jobs. The company said the decision was based on a falling bias truck tire market

resulting from the rise in demand for radials. The reduced production requirements will be consolidated at two other Goodyear plants in Topeka, KS, and Freeport, IL.

Standard Products will close its Lexington, SC plant due to the slowdown in the automotive industry and significantly decreased demand from its only customer, General Motors. The 52,000 square foot plant employs 130 hourly and 22 salaried workers and manufactures plastic moldings for doors and windows.

Markets, news

An influx of manufacturers from other nations are bringing their business to Indonesia. This, combined with newly formed joint ventures, is contributing to the country's growth in the footwear exporting industry. Many new plants springing up in Indonesia are joint ventures with Korea, Taiwanese or Hong Kong companies, proving a trend which sees an increase in foreign and domestic investments in the shoe industry. The joint ventures together exported \$57 million worth of rubber-soled running and other sport shoes in 1988, up from just \$10 million in 1987, according to information obtained from an agent of the Republic of Indonesia. Foreign investment has risen quickly in the Indonesian shoe market, from just two projects in 1987, to 17 in 1988, and another 15 starting in the first half of 1989. This represents a total of \$238 million in shoe-related investments in Indonesia in the last two and a half years. In addition, 26 domestically-owned projects contributed \$137 million to the figure.

Results of a survey of rubber manufacturers in the European Community undertaken by the rubber manufacturers associations in Belgium, France, Germany, Italy, The Netherlands, Spain and the UK revealed that processors would like to see improvements in purity, pollution, processability, physical properties and packaging. Respondents declared that quality standards for raw materials, including NR, must be maintained and improved; that there is a need for more communication between rubber producers and consumers to develop test methods, ranges of tolerances, etc., that can all be agreed upon; that purity problems would be improved if the collection and preparation of NR could be improved and standardized; to improve packaging, wood use in pallets and crates should be eliminated, packaging specifications from years ago should be revised, the gauge and wrapping material should be consistent within the specification, and bales should be uniform and production dated - with the grade and origin made easily identifiable.

Correction

The cover photo on the February 1990 issue of *Rubber World* was supplied by Akzo Chemicals Inc., not the company mentioned on the contents page.

RMA rubber report through October (figures in metric tons)

	YTD 1989	YTD 1988	% chg.
Total new rubber			
New rubber available	2,962,264	2,854,335	3.8
Imports	1,050,148	913,792	14.9
Exports	422,239	479,734	-12.0
Apparent consumption	2,499,590	2,390,344	4.6
Total natural rubber			
Imports	768,456	701,692	9.5
Exports	27,593	42,108	-34.5
Apparent consumption	751,263	707,661	6.2
Total synthetic rubber			
Production	1,912,116	1,940,543	-1.5
Imports	281,692	212,100	32.8
Exports	394,646	437,626	-9.8
Apparent consumption	1,748,323	1,682,676	3.9
Total SBR			
Production	741,066	756,770	-2.1
Imports	94,008	75,510	24.5
Exports	149,812	161,498	-7.2
Apparent consumption	669,455	645,729	3.7
Total nitrile			
Production	55,277	62,857	-12.1
Imports	13,894	13,984	-.6
Exports	15,912	12,952	22.8
Apparent consumption	52,486	63,215	-17.0
Polybutadiene			
Production	345,330	337,097	2.4
Imports	56,496	65,133	-13.3
Exports	68,487	54,330	26.1
Apparent consumption	316,544	338,317	-6.4
Ethylene-propylene			
Production	220,986	221,773	-.4
Imports	30,156	10,933	175.8
Exports	44,114	42,522	3.7
Apparent consumption	192,503	191,232	.7
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	549,458	562,045	-2.2
Imports	87,138	46,540	87.2
Exports	116,321	166,324	-30.1
Apparent consumption	517,335	444,170	16.5

Evaluating truck tire patents

by J.R. Dunn, J.F. Henderson and J. Smirle, *Noval/Polysar*

Assessment of trends and priority needs in an industry is an important feature in planning short and long term research by fabricators and by those who supply them with raw materials.

Trends may be determined in several ways, including:

- Discussion with end users, fabricators and their suppliers;
- Study of trade and technical literature;
- Evaluation of patents.

The three routes are complementary and each can be used to confirm conclusions drawn using the others. Direct discussion may not reveal a need which a company believes it can fully meet. Furthermore, if a company feels it can meet a major need, it may choose not to publicize the discovery or invention in the literature but it may find it advisable to protect it with patents. Consequently, patents are often the first indicator of emerging needs and major inventions, although it must be realized that some companies (especially those in Japan) have a policy of patenting most of their research while others (especially those in West Europe) appear to patent only those inventions that are valuable and are liable to be copied.

Until recently, the systematic study of patents on a broad topic would have been tedious and time consuming. The task has been simplified by:

- The availability of commercial data bases;
- The availability of sophisticated personal computers and programs for rapid data analysis.

In this study, patents on truck, heavy duty, farm and aircraft tires, applied for since the early 1970s, have been evaluated in order to determine how patent activity has grown in different geographical areas, the type and parts of the tire involved, the method used to improve the tire and the properties in which improvement has been sought.

Patent selection

Patents concerning truck and other heavy duty tires abstracted in the Derwent World Patent Index between 1975 and 1988 were scanned for relevance. These abstracts include a number of applications that were made prior to 1975. This provided a total of 552 inventions described in patent applications which have subsequently resulted in

patents in 470 instances and Japanese kokais in the remaining 82 instances. The Japanese kokais are publications of patent applications in Japan which may or may not eventually result in an issued patent.

Data entry

The data from the selected abstracts was analyzed using a Macintosh SE computer and a relational database program written in Omnis 3 software. The information entered for each invention included:

- Key identifier (country and identification number of initial filing) - a unique means of identifying basic patent applications and the resulting patents;
- Priority date;
- Derwent World Patent Index accession number;
- Assignee;
- Number of countries in which applications were filed;
- Number of U.S. patents arising from the application;
- Names of inventors (if available);
- An alphabetic code to identify the principal method or "technical approach" by which the tire is improved (see table 1);
- A series of "qualifiers" or five digit codes which permit the entry of extensive additional information. The first two digits (see table 2) indicate a broad field of information while the last three digits are used to indicate the detail within the broad field.

Data analysis

For analysis the relevant information was exposed to a spreadsheet in Microsoft Excel software. Graphs and pie charts were prepared with the aid of Cricket Graph software. The graphical data have been smoothed using three year by three year moving averages.

Determination of citations

In the U.S. patent system, prior art must be cited by the examiner on the front page of the patent. The number of citations a patent receives is a measure of its perceived importance - especially if it has been issued relatively recently and has been cited several times. In order to obtain information on citations, abstracts of the U.S. patents identified were sought from the Claims/U.S. Patent Database and the number of citations for each U.S. patent was included in our database.

Breakdown of information by company

Of the 470 applications resulting in patents on truck and heavy duty tires, 88 originated from five U.S. companies with 42 of these originating from Goodyear. The 88 applications resulted in 70 U.S. patents, some of them leading to more than one U.S. patent as indicated by 11 applications

Table 2 - broad field qualifiers

01 Type of tire
02 Part of tire
03 Type of material (non-rubber)
04 Design details
05 Compounding highlights
06 Type of polymer
07 Physical properties
08 Method of fabrication

Table 1 - technical approach (primary invention)

- B - Novel method of fabrication
- C - Novel compounding ingredient(s)
(e.g. reinforcing agent, plasticizer, antioxidant accelerator, curative, etc.)
- D - Novel design of all or part of the tire
- M - Novel material other than polymer or rubber composition (e.g. tire cord or belting material or coating)
- P - Novel or modified polymer or method of polymerization
- R - Novel blend of polymers

for BFGoodrich resulting in 13 U.S. patents.

Of the 470 patents, 81 originated from the five major European tire companies and Bayer, a synthetic rubber and rubber chemicals producer. Thirty-seven of these applications resulted in U.S. patents.

Of the 470 patents, 166 originated from four Japanese companies - 108 of them from Bridgestone. In addition, 64 of the 82 kokais originated from these companies. The Japanese applications resulted in 99 U.S. patents, i.e. more U.S. truck tire patents originated from the four Japanese companies than from the five major U.S. companies and Bridgestone obtained twice as many U.S. truck tire patents as any other company. The large number of U.S. truck tire patents of Japanese origin is surprising. In the 1984-86 period, 18% of all U.S. patents originated in Japan and 21% in Western Europe. Of the U.S. truck tire patents from major companies, over a longer period when the Japanese contribution would be expected to be less, 45% originated in Japan and 17% in Western Europe. This indicates a very strong Japanese interest in the U.S. truck tire market.

The average number of countries of filing is shown in figure 1. Although Japanese companies obtain many patents, they hold them in very few countries - frequently Japan and U.S. only. This may reflect the fact that Japanese companies have, until recently, concentrated on the Japanese and U.S. markets. U.S. companies, especially those which have, or have had, international organizations, file more broadly while European companies file very broadly, especially in Europe.

Figure 1 - top 15 companies (world): Average numbers of countries in which applications were filed

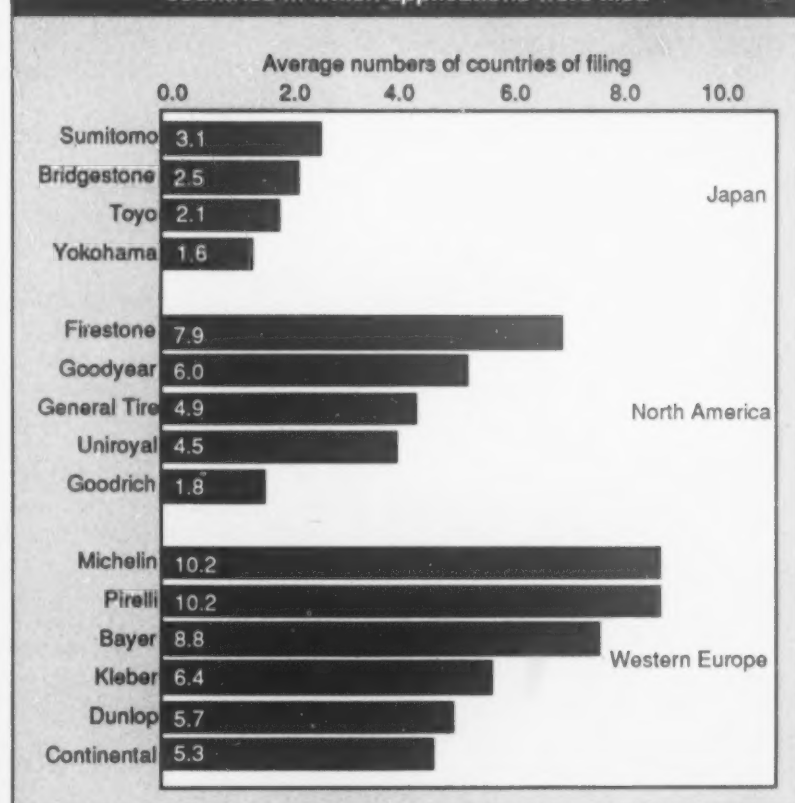
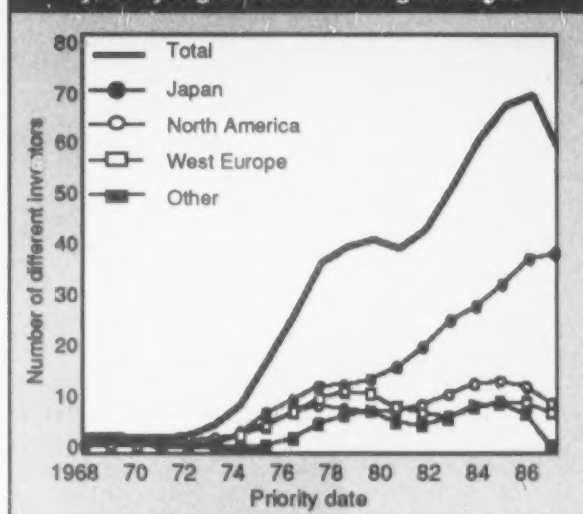


Figure 2 - number of different inventors per year by region: 3 x 3 moving averages



Bridgestone, Goodyear and Michelin are the three companies having the largest number of truck tire patents in the U.S. patent system.

Number of different inventors per year

The number of different inventors identified has grown steadily since 1972 (figure 2). It should be noted that Derwent World Patent Index began to identify inventors in 1978. The growth in identifiable inventors since 1978 is attributable to the growth in Japanese activity. The downturn in inventors in 1986 arose from a decline everywhere except in Japan, while a decline around 1980 was attributable to a decrease in West European inventors.

Tire types

The amount of activity on each tire type, divided in four time periods, between 1966 and 1986, is shown in table 3. Current interest appears to be mostly on truck and bus tires. Activity on earthmover tires was greatest between 1972 and 1976 and activity on off-the-road tires peaked between 1977 and 1981.

Insofar as there have been claims regarding special properties, there appears to be current interest in "all weather" and run flat or safety performance in truck and heavy duty tires.

Technical approach

The number of patents and kokais devoted to each technical approach is: B - 78(13); C - 28(20); D - 291(17); M - 37(18); P - 18(5); R - 18(9). About 60% of the patents concern changes in design and almost 20% concern changes in manufacturing. For the purposes of this article the term

Table 3 - tire types by 5-year period

Types of tire	Number of patents (kokais) in time period				
	1966-71	1972-76	1977-81	1982-86	Total
Truck/bus	9 (0)	34 (1)	61 (14)	121 (36)	225 (51)
Heavy duty	10 (0)	31 (0)	78 (6)	81 (20)	200 (26)
Off-the-road	3 (0)	25 (0)	32 (2)	21 (3)	81 (5)
Farm/agriculture	5 (0)	16 (1)	20 (1)	20 (3)	61 (5)
Earthmover	1 (0)	12 (0)	6 (0)	4 (0)	23 (0)
Aircraft	1 (0)	8 (0)	7 (3)	13 (5)	29 (8)
Fork lift solid	-	8 (0)	5 (2)	7 (0)	20 (2)
All weather	-	1 (0)	-	5 (2)	6 (2)
Winter	-	3 (0)	1 (0)	-	4 (0)
Runflat/safety	-	4 (0)	4 (1)	8 (0)	16 (1)
Self seal	-	1 (0)	1 (0)	-	2 (0)

'design' includes both the design of individual components (such as the tread) and the configuration of components within the tire; the term 'manufacturing' covers the equipment and process of manufacturing. Comparatively few patents concentrate on compounding or novel polymers or blends.

It can be seen that over 25% of the kokais concern compounding and 12.5% of the kokais concern rubber blends, which is a much higher percentage than that of granted patents that apply to these topics. Inventions in such areas may frequently be regarded as 'obvious' by a patent examiner.

Polymer types specified in truck tire patents

The polymers and blends referred to in the four time frames from 1966 to 1986 show that most of the activity on polymers has been in the 1982-86 period. No polymer has emerged as the center of attention and there is no evidence that specialty polymers are being developed for truck tires. This appears to be a need to which polymer producers have been reluctant to pay attention.

Citations

Of the 470 applications on which patents have been granted, only 25 have been cited five or more times. Since 1978 only about one patent per year has been cited five or more times. Patents filed in the mid 1970s include two or three each year which are highly cited - many of them were on design - but around 1975, some highly cited patents on novel rubbers or blends were issued. The low citing frequency suggests that most inventions pertaining to truck tires have been incremental, often building on basic inventions made in passenger tires.

Breakdown of activity by geographic region

Comparison of activity by region, using all patents, is made difficult by the fact that the patent information is issued in some countries prior to examination and examination is more demanding in certain countries. This problem may be overcome by making comparisons in a single system, e.g. U.S. patents, but this practice gives undue weighting to patents of U.S. origin. However, it is generally more meaningful to examine trends and new directions in patent activity rather than the number of patents being issued in a region or country.

Since 1977, growth in activity on truck tires can be accounted for by work in Japan. While activity elsewhere shows a tendency to decrease, that in Japan appears to be growing unabated.

Concerning the activity by geographic region with kokais excluded, the story remains much the same. Japanese activity on issued patents continues to increase. It showed a shallow dip in the early 1980s. With the effect of kokais excluded, the fall-off in total activity, due to decline outside of Japan, is more apparent.

The geographical distribution of activity in a single system (U.S. patents) shows the number of patents of U.S. origin per year declined between 1977 and 1980, increased steeply until 1983 and then increased more slowly. The number of U.S. patents of

Japanese origin per year levelled off in 1977 but surpassed the number of patents of U.S. origin in that year and continued to do so.

Activity on truck tires by technical approach

Not only are more than half the total patents and kokais the result of design innovations, but the number arising from design changes is growing more rapidly than changes related to compounds or polymers. North American activity has been variable with a sharp dip around 1980, reflecting the recession and a steep drop between 1984 and 1986, presumably due to take-over threats and mergers in the North American industry. It is design activity which is cyclical. Activity on novel polymers and blends peaked around 1975 and has tended to grow from a low point around 1980.

West European activity peaked around 1977 and has always been mostly on design. Japanese activity, although predominantly on design, showed a peak in activity on novel polymers and blends around 1981 and now indicates some concentration on compounding.

Activity on truck tire treads

Of 552 patents and kokais on truck and heavy duty tires, 158 make specific reference to the tire tread. In truck tires, as in passenger tires, improvements in the tread are the primary concern of the tire industry.

Activity on truck tire treads in Japan has been growing since 1974, although the pace of growth has slackened somewhat recently. West European activity on treads has kept a steady pace around two patents per year while U.S. activity peaked in the middle 1980s and declined sharply after 1984.

Until about 1975, all activity on truck tire treads involved changes in design. Activity on novel polymers and blends peaked around 1982 and has been overtaken by activity on compounding.

Activity on truck tire sidewalls

There has been much less activity on truck tire sidewalls with a total of only 19 patents and kokais. The overall pattern is unusual since activity peaked around 1978 and is now very small. U.S. activity peaked in the mid 1970s and Japanese activity peaked around 1981. Overall, European activity has been dominant with a peak around 1983, but

current activity appears to be only in Japan.

Design changes to improve the sidewall peaked around 1978 and 1983-84. What little activity there has been on novel polymers or blends peaked around 1981.

Physical properties

The physical properties referred to in truck and heavy duty tire patents are tabulated in four time intervals between 1966 and 1986 in table 4.

The broad term durability is used in 144 of 470 patents and improvements in durability are clearly growing in importance.

105 patents and 16 kokais refer to a number of strength and failure related properties, the single most important being delamination resistance which was the subject of several patents in the 1977-81 period.

Wear or abrasion resistance was the subject of 99 patents and 18 kokais with the greatest activity in the 1982-86 period. This includes 49 patents referring to uneven wear of truck tires of which 31 were applied for between 1982 and 1986.

Skid resistance, grip and traction have also been of major and growing interest, although the increase in activity between 1977-81 and 1982-86 was not as great as for that on wear. Interest in wet skid resistance was very strong in the 1982-86 period. The activity on snow traction is also of interest. It has not been large but it has taken place almost ex-

clusively since 1982.

There have been many patents referring to dynamic properties with indications that interest is growing. In particular, most of the activity on rolling resistance and truck tire noise has been in the 1982-86 period.

Surprisingly, there have been very few truck tire patents concerning polymer processability or liner impermeability.

Durability

Most of the increase in activity on truck tire durability has been, and continues to be, in Japan. Activity has been steady in Western Europe since the mid 1970s, while that in North America has increased very slowly.

Wear resistance

Most of the increase in work on wear resistance since the mid 1970s has been in Japan. There has been a recent slackening of issued patents but growth in the issuing of kokais on the topic continues. Interest in wear in North America has been apparent since the late 1970s but, in contrast with Japan, the level of activity has been steady or declining since 1982.

Interest in uneven wear follows a similar pattern. However, worldwide interest seems to be declining and that in Japan is no longer growing. West European activity peaked in the mid 1970s while that in North America grew in the early 1980s and is now declining. It appears that uneven wear may be less of a problem as radial truck tires become more widely accepted.

Table 4 - physical properties by 5-year period

Property	Number of patents (kokais) in time period				
	1966-71	1972-76	1977-81	1982-86	Total
Physical properties	4 (0)	28 (1)	36 (4)	37 (11)	105 (16)
Strength	-	4 (0)	3 (0)	3 (6)	10 (6)
Cut resistance	-	9 (0)	2 (2)	4 (3)	15 (5)
Crack resistance	-	1 (1)	7 (1)	7 (1)	15 (3)
Cut/crack growth resistance	-	-	-	5 (0)	5 (0)
Delamination resistance	-	5 (0)	15 (1)	5 (1)	25 (2)
Green strength	-	2 (0)	1 (0)	3 (0)	6 (0)
Wear/abrasion resistance	4 (0)	18 (0)	27 (5)	50 (13)	99 (18)
Uneven wear resistance	1 (0)	4 (0)	13 (0)	31 (1)	49 (1)
Skid resistance/grip/traction	3 (0)	13 (0)	25 (0)	36 (4)	77 (4)
Wet skid resistance	-	3 (0)	4 (0)	19 (2)	26 (2)
Ice traction	-	-	1 (0)	0 (2)	1 (2)
Snow traction	1 (0)	-	-	5 (1)	6 (1)
Dynamic properties	3 (0)	5 (0)	21 (6)	34 (13)	63 (19)
Rolling resistance	-	-	5 (3)	13 (3)	18 (6)
Low heat build up	2 (0)	4 (0)	8 (2)	9 (6)	23 (8)
Vibration damping	-	-	7 (0)	7 (0)	14 (0)
Noise reduction	-	-	1 (0)	4 (2)	5 (2)
Durability	5 (0)	28 (0)	39 (7)	72 (21)	144 (28)
Heat resistance	-	3 (0)	5 (1)	4 (3)	12 (4)
Ozone resistance	-	-	0 (1)	0 (1)	0 (2)
Puncture resistance	-	1 (0)	7 (0)	2 (0)	10 (0)
Adhesion	1 (0)	2 (0)	7 (2)	8 (2)	18 (4)
Processability	-	1 (1)	1 (0)	2 (1)	4 (2)
Low permeability	-	1 (0)	1 (0)	0 (2)	2 (2)

Skid resistance

Skid resistance of truck tires is receiving little attention currently, outside of Japan, and activity there may have peaked also. Skid resistance received attention in Western Europe in the mid 1970s and some in North America in the early 1980s.

Since about 1977, almost all patents concerning wet skid resistance of truck tires have originated in Japan, although since the early 1980s there has been increased interest in Western Europe.

Dynamic properties

There is considerable growth in the number of patent applications in Japan concerning dynamic properties of truck tires. Much of this growth is in the number of kokais. North American activity has been very low except in the early 1980s, while that in Europe has maintained a steady pace.

Much of the work on truck tire rolling resistance has been done in Japan and almost all of the recent work has been there. Activity in both Western Europe and North America peaked around 1983. The number of Japanese patents concerning heat build-up has stayed steady since the mid-1970s, but the number of kokais con-

Table 5 - topics of interest in truck tire patents

Topic	Emerg. Maximum		Trend setter
Tread	1972	1985	W. Europe
Sidewall	1973	1978	N. America
Durability	1971	Increasing	All
Wear resistance	1970	1985	W. Europe
Uneven wear	1974	1984	Japan/N. Am.
Skid resistance	1971	1984	W. Europe
Wet skid resistance	1978	Increasing	Japan
Dynamic properties	1972	Increasing	Japan
Rolling resistance	1976	Increasing	W. Europe
Low heat build up	1972	Increasing	N. America
Delamination	1972	1979	W. Europe

tinues to grow. North American interest in heat build-up has been very low.

Delamination resistance

As noted earlier, concern regarding delamination resistance peaked around 1979-80. The problem was addressed in Western Europe around 1976, and in Japan interest peaked around 1980 but work continued until the mid 1980s. This has not been a topic of interest in North America.

Summary and conclusions

Computer assisted patent analysis has provided insight into trends and needs in truck and heavy duty tires, where those

concerns are being addressed and by what methods.

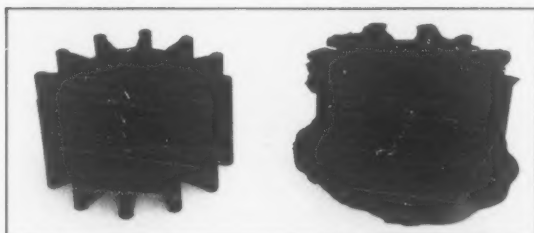
The number of patents filed on truck tires is increasing each year, largely because of applications of Japanese origin. The number of inventors in Japan is also increasing rapidly. The number of truck tire patents granted annually to North American and West European companies remains about the same. The number of patents filed by a West European company is relatively small, but they are filed and issued in a large number of countries.

Many of the truck tire patents concern truck tire tread, and only a few refer to sidewall. Treadwear, and specifically uneven wear, is a topic of major interest. Skid resistance has been a major topic but, so far as truck tires are concerned, interest may be waning. There has been some work on winter traction in the last few years, as well as work on tire noise. Heat build-up and, latterly, rolling resistance are also topics of interest. A more general topic of major interest is tire durability.

The date and region of origin, together with the year of maximum activity of inventions on a number of topics related to truck tires, are summarized in table 5. There are five topics which are currently increasing in importance, namely: durability, wet skid resistance, dynamic properties, rolling resistance and heat build-up.

There have been relatively few patents regarding novel polymers or polymer blends for use in truck or heavy duty tires. NR, alone or blended with BR or SBR, remains the elastomer of choice.

Simple Deflashing



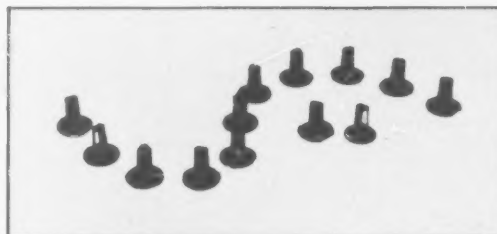
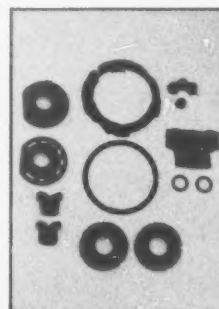
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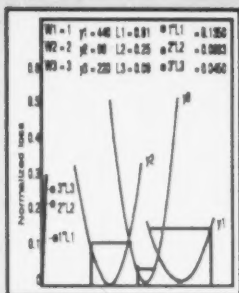
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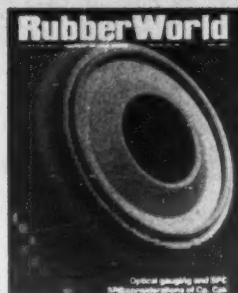
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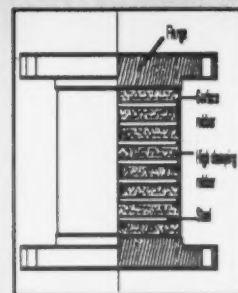
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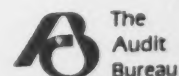
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A Lippincott & Peto Publication



Editorial

A couple of surveys released during the recent Society of Automotive Engineers meeting have provided a little bit of a silver lining to the state of gloom and doom stories associated with the auto industry in the U.S. But those stories just reflect the business performance of the domestic-owned auto companies and as many suppliers know, they aren't the only players in town.

"Plain talk on selling the transplants" conducted by Markey and Associates, and a Market Opinion Research survey of automotive design engineers point to the opportunities available to suppliers now and what to expect by the end of the decade. The Markey group surveyed engineers and component specifiers in Japanese automotive manufacturing plants in the U.S. Some of their findings show that 83% of the respondents cited SPC/Quality Control as the number one criteria for selecting a U.S. supplier; 55% listed research and development as the second most important; of the component specifiers, price ranked second among 64% of this group. The interesting results, however, are that 85% in the survey said they are currently seeking involvement of U.S. suppliers and that the participants expect to increase the number of U.S. supplied components by 46% in the next five years. The survey indicated that presently 28% of the suppliers for the transplant's projects-in-progress are domestic

The MOR study, done for Mobay Corp., also indicates more business for suppliers. This survey of automotive design engineers from both the manufacturing and supply sectors indicates that 70% think the number of partnerships between automotive companies and material suppliers will increase in the future while only 11% foresee a decrease. Other findings show that 89% of those surveyed say thermoplastics will increase; 18% saw an increase in rubber usage; 53% said silicones were considered the most likely material to make inroads in under-the-hood applications; 40% of all bumpers by the year 2000 will be comprised of RIM urethane, while 38% will be comprised of thermoplastics.

The business is out there. The materials and the customers might be changing, but it appears to be still growing. The elastomeric parts and material suppliers that exhibited at the SAE show seem to have grasped these realities and are positioning themselves to take advantage of the growth opportunities. If the domestic auto industry wants to self destruct the rubber industry doesn't have to follow along.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

A definitive agreement has been reached between a management group in association with Mitsubishi to acquire **Aristech Chemical** for \$27 per share in cash for all outstanding common shares. A cash tender offer will begin immediately, and is conditional based on the number of shares validly tendered, along with the number of shares being contributed by management, to total a majority of the outstanding shares. The agreement allows Aristech to continue to provide information to or solicit proposals from other potential bidders. **Huntsman Holdings** and **GE Plastics** told Aristech that they may be prepared to offer at least \$27 per share unless materially negative information arises from due diligence. In the event the offer between the Mitsubishi/management group is not completed, Aristech will pay the group up to \$13 million of actual, reasonable expenses incurred in connection with the transaction, according to the agreement. The management group will purchase approximately 12.5 percent of the common stock equity of a new holding company of which Aristech will be a subsidiary.

Custom dip and blow molder, **Steere Enterprises**, opened a 47,000 square foot manufacturing facility in Mog-

adore, Ohio designed to produce blow molded components and serve as a central warehouse for finished goods. All shipping and receiving functions will be handled from this location.

Morton International will acquire the specialty chemicals unit, which primarily produces adhesives, and the coatings group of **Whittaker Corp.** for about \$225 million plus assumption of certain liabilities.

The **Fisons Instruments** division of **Fisons plc** in the United Kingdom purchased **VG Instruments**, a supplier of mass spectrometers and surface analysis instruments, for

RMA rubber report through November (figures in metric tons)

	YTD 1989	YTD 1988	% chg.
Total new rubber			
New rubber available	3,291,152	3,152,578	4.6
Imports	1,156,016	1,007,713	14.7
Exports	458,750	522,832	-12.3
Apparent consumption	2,799,178	2,648,476	5.9
Total natural rubber			
Imports	848,137	779,128	8.9
Exports	29,341	46,556	-37.0
Apparent consumption	836,625	783,048	6.8
Total synthetic rubber			
Production	2,135,136	2,144,865	-.2
Imports	307,879	228,585	34.7
Exports	429,409	476,276	-9.8
Apparent consumption	1,962,563	1,865,421	5.5
Total SBR			
Production	816,011	834,149	-1.5
Imports	102,279	82,866	23.4
Exports	160,271	175,100	-8.5
Apparent consumption	741,680	720,997	3.7
Total nitrile			
Production	64,282	69,422	-7.4
Imports	15,095	15,103	-.1
Exports	17,274	13,929	24.0
Apparent consumption	60,890	68,400	-11.0
Polybutadiene			
Production	390,944	373,103	2.2
Imports	62,225	70,170	-11.3
Exports	75,804	60,672	24.9
Apparent consumption	348,048	373,719	-6.8
Ethylene-propylene			
Production	242,291	243,341	-.4
Imports	31,345	12,778	145.3
Exports	50,129	45,574	10.0
Apparent consumption	211,045	210,966	.0
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	631,608	624,850	1.1
Imports	96,935	47,668	103.4
Exports	125,931	181,001	-30.4
Apparent consumption	600,899	491,339	22.3

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Business Briefs

Arco will implement a CFC phase-out program by the end of 1990, aiming for the elimination of the use of blowing agents in automotive seating, bumper systems and headliners. Presently, modifications are in place to enable the production of higher density Arpro expanded polypropylene foams without the use of CFCs, and implementation should be completed by the end of June.

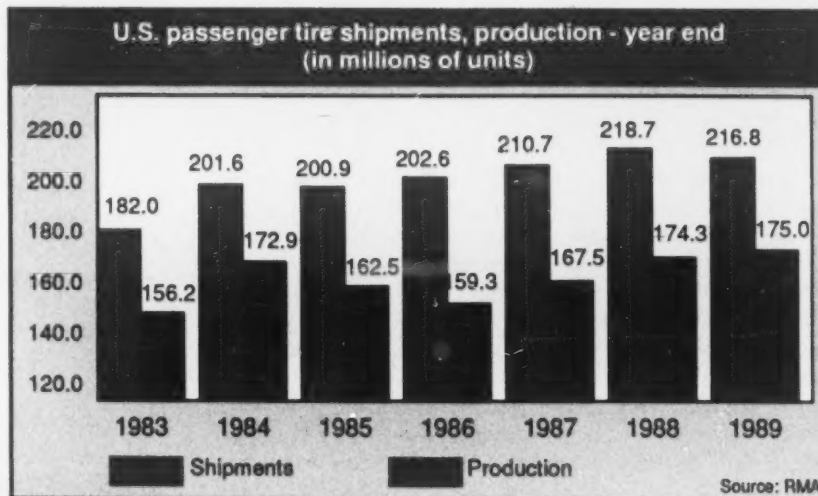
Arco Chemical reported 1989 net income of \$405 million on revenues of \$2.7 billion.

Bridgestone/Firestone enacted price adjustments ranging from -1.5 percent to 5.0 percent on Bridgestone brand tires sold in the U.S. Specifically, Bridgestone's S402, 212V and 207V lines increased 3.0 percent; commercial light truck tires increased 5.0 percent; in-line adjustments were made to the prices of truck and bus tires; and net actual price adjustments from -1.5 percent to 2.0 percent were made on the company's off-the-road pricing structure, depending on the line.

Cabot reported 1989 net income of \$14.2 million from net sales and other operating revenues of \$1.9 billion.

Cooper Tire & Rubber reported net income for 1989 was \$58.2 million and net sales were \$866.8 million.

Davis-Standard announced sales in 1989 of \$74.8 million.



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Available in easy-to-handle 50 lb. bags, Chlorez 700-DF flakes save time and money. For more information contact Dover Chemical Corp., Dept. DV-75, P.O. Box 40, Dover, Ohio 44622, (216) 343-7711.

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Business Briefs

ments showed the largest increase, 32.8 percent for the year.

Shipments of truck and bus tires climbed 2.5%, from 46.0 million units in 1988 to 47.1 million units in 1989. Truck and bus tire production increased by 2.3%, from 37.0 million units to 37.8 million units. Original equipment shipments dropped 7.1% over 1988, and replacement tire shipments rose 4.5%.

Rubber-based, single-ply roofing systems are predicted to account for as much as 90 percent of new growth in the overall domestic non-residential roofing activity in 1990, according to the Rubber Manufacturers Association's Roofing Products Division forecast. Overall, domestic non-residential roofing activity is expected to be relatively flat in 1990 and 1991, with growth projected at 2 percent. Total U.S. non-residential roofing is expected to grow from three billion square feet in 1990 to 3.060 billion in 1991. Rubber-based single-plys are projected to climb from 1.095 billion square feet in 1990 to 1.150 billion in 1991.

Of the 60 million square feet of total non-residential roofing growth projected between 1990 and 1991, rubber-based single-plys will account for 55 million square feet, or more than 90 percent, according to the forecast. RMA also predicts that total single-ply roofing construction will grow from 1.895 billion square feet in 1990 to 1.99 billion in 1991, rising from 63 percent of the total non-residential roofing market to 65 percent by the end of 1991. By then rubber-based single-ply will command 58 percent of all single-ply construction, and 38 percent of total non-residential roofing, according to RMA.

An environmental excise tax, part of two new sections of tax code contained in the Revenue Reconciliation Act of 1989, requires U.S. manufacturers who use ozone-depleting chemicals to pay quarterly payments beginning in April on all chlorofluorocarbons (CFCs) used since January 1, 1990. CFCs are used in the manufacture of air conditioners and automotive seating, among other uses. Manufacturers will pay varying amounts depending on the type of CFC used. They will pay an excise tax of \$1.37 per pound of CFC

used in 1990. The tax increases to \$1.67 per pound in 1992 and \$2.65 per pound in 1993.

The U.S. adhesives and sealants industry registered sales in 1989 valued at \$8.7 billion and shipped 12.4 billion pounds, an increase of 8 percent over 1988 dollar figures. However, industry growth is expected to slow from the 9 percent growth rate during the last decade to about 7 percent a year, due to continued moderate construction, and sluggish production of vehicles and other durable goods, according to Rauch Associates, a marketing consulting and industry information firm based in Bridgewater, NJ.

In 1994, total adhesives and sealants consumption will increase to \$12 billion, according to Rauch.

Current adhesives sales are estimated at \$6.915 billion and 10.5 billion dry pounds. They are comprised of merchant sales of mainly formulated products that account for 74 percent of adhesive consumption, but only 50 percent of total adhesives volume.

The balance is in captive production by users of larger quantities that have generally less critical applications. Binders for primary wood bonding, carpet backing and foundry uses include synthetic and natural lattices that account for 15 percent of adhesives sales but over 40 percent of their volume.

Sealant sales are estimated at \$1.785 billion and 1.9 billion dry pounds. Besides traditional uses, Rauch includes PU appliance wall foam interface sealants, plastisols, automotive fillers, pavement joint fillers and grouts and putties.

laboratory and consulting services for the rubber industry

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RMA tire report - December (figures in thousands of units)

Passenger tires	YTD '89	YTD '88	% change
Shipments			
original equipment	51,170	54,131	-5.5
radial	44,654	46,260	-3.5
replacement	153,281	155,294	-1.3
radial	146,157	145,579	0.4
export	12,437	9,365	32.8
radial	11,617	8,383	38.6
total	216,888	218,790	-0.9
radial	202,428	200,222	1.1
Production			
radial	175,026	174,341	0.4
radial	164,249	159,202	3.2
Truck & bus tires			
Shipments			
original equipment	8,177	8,801	-7.1
radial	6,833	6,639	2.9
replacement	35,436	33,918	4.5
radial	21,369	20,207	5.8
export	3,548	3,301	7.5
radial	2,645	2,550	3.7
total	47,161	46,021	2.5
radial	30,847	29,397	4.9
Production			
radial	37,844	37,010	2.3
radial	25,544	23,055	10.8

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RubberWorld

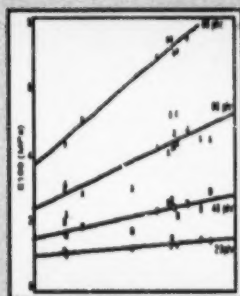
The magazine for the rubber industry

Volume 202, No. 2

May 1990



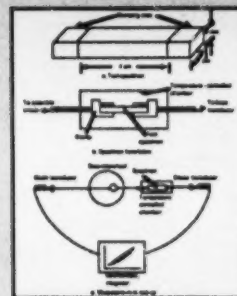
Fatigue endurance, viscoelastic hysteresis of SFRCs
Carbon black and compound performance of IRPs
Compounding, vulcanization latitudes of SBB
Effect of silica structure on resilience



Carbon black p. 19



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Short fiber/rubber composites p. 29

6 Business Briefs

Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.

14 Tech Service: Robust process engineering

by Jon Menough, contributing technical service editor. This month's column looks at the Catalyst/RPE software package from Catalyst Inc., designed for engineers for process performance improvement.

16 Patent News

edited by Bob Samples, Akron Rubber Development.

19 Industrial rubber products: Carbon black and compound performance

by J.M. Funt and B. Chung, Cabot Corp. A comparison of the general effects of carbon black type and loading in a series of rubbers used in industrial products shows that the changes in properties are similar for all rubbers, but the magnitude depends strongly upon the specific rubber.

29 Fatigue endurance and viscoelastic hysteresis of short fiber/rubber composites

by Y.D. Kwon, C.W. Beringer, M.A. Feldstein and D.O. Prevorsek, Allied Fibers Division, Allied-Signal Inc. The authors believe that the low modulus nylon 6 fiber of those tested best meets the requirements of good fatigue resistance for short fiber reinforced composites for tire applications.

35 The effect of silica structure on resilience

by N.L. Hewitt, PPG Industries. Removing water from silica, by drying or use of appropriate additives, is necessary to break down the characteristic agglomerates to provide a filler structure of lower hysteresis.

41 Star-branched butyl: Compounding and vulcanization latitude

by L. Gursky, J.V. Fusco, I. Duvdevani and T. Takeda, Exxon Chemical, Polymers Group. Star-branched butyls were found generally to have significant benefits in green strength, stress relaxation and extrusion characteristics over a wide range of black and oil levels.

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Cover photo courtesy of Cabot Corp.

A Lippincott & Peto Publication

Editorial

It is somewhat disappointing that there was no mention of recycling rubber back into products by the Rubber Manufacturers Association when they announced the formation of a council on scrap tire disposal. It appears that the thrust of the council will be to push incineration as the answer to the mounting scrap tire problem. Even though the RMA announced that the council would develop a comprehensive program to find sound economic and environmentally acceptable solutions to scrap tire disposal there is no mention of reuse within the industry. The RMA says the council, under its initial framework, would be staffed with technical and marketing professionals who would organize a program of industry supported activity to: encourage the use of scrap tires as a fuel source; assist waste haulers in identifying sources of waste tires and encourage development of scrap tire collection; advise state and local officials on their own scrap tire plans and to publicize scrap tire disposal success stories. These activities are a good step forward for an industry that historically has taken the stance that scrap tires weren't its concern.

But now, when it appears that legislation is forthcoming from federal, state and municipal governments concerning this issue, the thrust of the RMA is to encourage others to take the problem off their hands. Reducing the scrap tire problem through burning should not be the only solution offered by such a technically advanced industry.

Burning is a solution to the scrap tire problem. It's the cheapest and takes the least industry involvement. It also might be a quick remedy to the growing problem of landfill space. But this isn't what recycling is about. The RMA estimates that between 200 and 250 million scrap tires are generated in the U.S. so it is an ongoing problem. Is burning environmentally safe now? Will it be next year? How about five years from now?

The majority of materials that make up a tire come from non-renewable resources and the industry should be exploring ways of incorporating recycled material back into the product. It's amazing to me that an industry that has accepted numerous challenges throughout its history and has been successful on most fronts would seem to dodge the challenge of using its own material back into its product. I hope the RMA and the industry seriously looks at the recycling issue and attempts to actually recycle its product as a responsible industry must.

Don R. Smith
Editor

RubberWorld

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- Automotive Polymers & Design
- Blue Book: Materials, Compounding Ingredients, and Machinery for Rubber

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Business Briefs

Acquisitions, expansions

Lexington Precision merged its two rubber fabricating units, Stalwart Rubber and Elastomeric Products, and formed Lexington Components (LCI), as a wholly owned subsidiary. An LCI sales and technical service office will be opened in Detroit, MI and a 52,000 sq. ft. manufacturing facility in Warren, OH, will open in June. LCI will invest more than \$3.7 million in this facility in 1990. The company will also consolidate the manufacture of silicone and organic rubber insulators at its Jasper, GA plant. More than \$1 million will be spent to expand and modernize the plant. Construction will soon begin on a 3,200 square foot testing laboratory and quality control center. As a result of the consolidation at Jasper, production of LCI's Burton, OH plant has been cut back and will close by June 1.

BASF will spend \$17 million to build a plant to produce Elastollan polyurethane elastomer resins at Wyandotte, MI. BASF will furnish the key raw materials necessary for production from its own facilities. The Wyandotte plant will make both polyester- and polyether-based polyurethane elastomer resins for injection molding, blow molding and extrusion.

Mexico's Novum Group acquired a majority equity position in Hules Mexicanos, S.A. (Humex), increasing No-

vum's production capacity in carbon black by 247%, from 65,000 to 161,000 metric tons per year, and various synthetic rubbers by 197%, from 80,000 to 155,000 metric tons annually.

Minnesota Rubber opened operations of a 30,000 square foot manufacturing plant in Singapore. The company will spend \$5 million over five years to develop the factory in Tuas into a world class manufacturing facility, specializing in custom molded rubber components. Currently the plant employs 30. Some of the workers are being trained at Minnesota Rubber's Minneapolis, MN plant.

1989 RMA rubber report
(figures in metric tons)

	1989	1988	% chg.
Total new rubber			
New rubber available	3,534,917	3,436,340	3.1
Imports	1,234,097	1,107,617	12.0
Exports	498,116	570,214	-12.6
Apparent consumption	3,005,611	2,875,129	4.8
Total natural rubber			
Imports	909,415	853,862	6.5
Exports	30,468	54,924	-44.5
Apparent consumption	889,514	858,277	3.6
Total synthetic rubber			
Production	2,301,820	2,334,722	-1.1
Imports	324,682	247,758	31.0
Exports	467,648	515,290	-9.2
Apparent consumption	2,116,108	2,018,848	5.3
Total SBR			
Production	873,780	909,487	-3.2
Imports	109,006	91,458	19.2
Exports	175,723	189,097	-7.1
Apparent consumption	793,081	778,058	2.8
Total nitrile			
Production	69,236	76,294	-9.2
Imports	15,776	16,579	-4.8
Exports	18,237	15,065	21.1
Apparent consumption	65,645	53,676	-10.9
Polybutadiene			
Production	411,485	407,178	1.1
Imports	65,457	75,239	-13.0
Exports	82,267	66,993	22.6
Apparent consumption	374,723	406,060	-7.8
Ethylene-propylene			
Production	259,576	263,089	-1.3
Imports	32,367	15,307	111.4
Exports	55,875	47,908	16.6
Apparent consumption	229,655	229,820	-.4
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	687,762	678,674	1.3
Imports	102,076	49,174	107.6
Exports	135,546	188,227	-30.9
Apparent consumption	653,729	529,232	23.5

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Business Briefs

Silicones for use in their process.

Dayco Products acquired 100% ownership of its timing belt plant, a joint venture with Uniroyal Manuli Rubber S.R.L. The new company, Dayco Italy, S.p.A. will expand the plant to produce other rubber products in addition to timing belts.

Saudi Basic Industries signed a construction contract to expand ethylene production at its wholly-owned affiliate Arabian Petrochemical in Al-Jubail Industrial City. The contract covers engineering, detailed design, construction and purchasing. The contract will be 33 months, and the plant is expected to go on-stream in 1993. Capacity of the plant will be 500,000 metric tons per year of ethylene, and other products will include 300,000 mt/y of propylene, 100,000 mt/y of butadiene and 70,000 mt/y of benzene.

Georgia-Pacific Resins purchased five resin formulations from Union Carbide for use as hardeners in epoxy crosslinking systems.

MDA Scientific of Lincolnshire, IL acquired the assets of the former Tecan Remote, which developed remote sensing products, located in Norcross, GA. MDA Scientific manufactures a wide range of instruments employed for detecting toxic and trace gases.

U.S.-based Sartomer and French-based Craynor will

join Total, a \$15 billion dollar French oil and chemical company. The companies will share resources and cooperate on all activities relating to the marketing, research and development, manufacturing and distribution of oligomers and monomers on a global basis. Craynor will market Sartomer's product line in Europe.

Sartomer moved its corporate headquarters from West Chester, PA to an expanded facility in Exton, PA, that will house its corporate and administrative offices.

Dexter made an agreement in principle to acquire all of the issued and outstanding shares of Crown Metro Aerospace Coatings, a majority-held subsidiary of Crown Metro, of Greenville, SC. The purchase price was not disclosed. The CMAC business will be operated by its present management as part of the Dexter Specialty Coatings Division, headquartered in Waukegan, IL.

Swedish based SKF, a manufacturer of rolling bearings, has drawn up a definitive agreement under which it will acquire from Ifint S.A., a Luxembourg holding company, all the stock of Ifint's wholly-owned subsidiary, CR Industries. CR Industries (Chicago Rawhide Manufacturing), a producer of fluid sealing devices, has 10 manufacturing plants in the United States, two in Canada and joint ventures in Japan and Mexico.

Amoco Chemical will construct a world-scale polypropylene unit at its Chocolate Bayou, LA plant. Based on Amoco's proprietary gas-phase process and high-yield catalyst, the unit will add 300 million pounds per year of capac-

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RMA tire report - January
(figures in thousands of units)

Passenger tires	YTD '90	YTD '89	% change
Shipments			
original equipment	2,878	4,740	-39.3
radial	2,503	4,125	-39.3
replacement	11,992	11,740	2.1
radial	11,552	11,043	4.6
export	1,071	1,086	-1.4
radial	1,024	986	3.9
total	15,941	17,566	-9.3
radial	15,078	16,154	-6.7
Production	15,516	15,514	--
radial	14,937	14,368	4.0
Truck & bus tires			
Shipments			
original equipment	548	745	-26.5
radial	471	614	-23.3
replacement	2,986	2,836	5.3
radial	1,811	1,648	9.9
export	289	319	-9.5
radial	222	242	-8.4
total	3,822	3,900	-2.0
radial	2,504	2,504	--
Production	3,371	3,430	-1.7
radial	2,351	2,238	5.0

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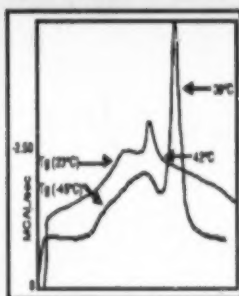
The technical service magazine for the rubber industry

Volume 202, No. 3

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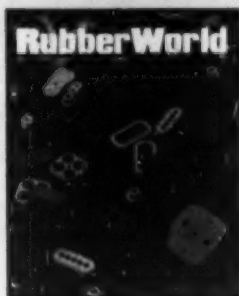


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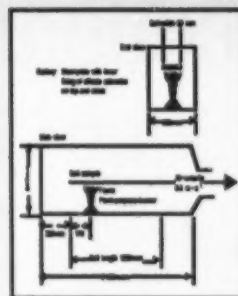


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Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.

14 Patent News

edited by Bob Samples, Akron Rubber Development.

16 Tech Service: Chemical exposure at work

by Jon Menough, contributing technical service editor. This column focuses on the needs and requirements of smaller companies to improve working conditions and reduce worker exposure to chemicals.

19 A new CPE for elastomer applications

by Milton Farber, Uniroyal Chemical Co. Improved physical properties and heat resistance possible with chlorinated polyethylene, coupled with ease of handling and absence of sodium ion in the raw form, make it an attractive candidate for sponge, hose, wire and cable, and other applications.

26 High-strength compound of highly saturated nitrile and its applications

by R.C. Klingender, M. Oyama and Y. Saito, Zeon Chemicals, Inc. The authors show how the properties of highly saturated nitrile butadiene rubber can be improved by modification with a combination of zinc oxide and methacrylic acid to replace polyurethanes in hoses, belts, seals and other applications.

33 Silicone usage expanding in European automotive applications

by Don Finney, GE Silicones. The increased use of silicones in European automobiles is predicted over the next decade because of greater attention to higher operating temperatures.

39 XD-modified polychloroprene grades for mining conveyor belts

by J. Pabst and E. Rohde, Bayer AG. An improved polychloroprene, modified with xanthogendisulfide derivatives, is described for use in mines where flame retardancy is of paramount importance.

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Cover

Cover photo courtesy of Wacker Silicones Corp.

A Lippincott & Peto Publication



Editorial

"The future of American industry depends on successfully developing new technology and how well we educate and develop the people we need to keep us technologically competitive." There's no need to identify the author of this quote because it's generic. It or something similar has probably been uttered thousands of times by company chairman, CEOs and a plethora of speech makers spanning most of industry. The quote accompanies the warning that the competition internationally is doing this and then there is usually a dig at the American educational system. The speaker then exhorts the audience to get involved.

The theme of quality also has its stock speech that many executives use. It seems that speech writers have a general formula for this type of speech as well. And like the quality issue, the educational issue is falling under the category of lip service. Many executives can talk a good game, but when it comes to implementation the bottom line appears to get in the way. The rubber industry is not immune to this. The attendance at the recent spring Rubber Division meeting of a little over 80% represented only around 20% of the membership. Excuses have been offered but none seem to carry much weight. It appears the venue presented an opportunity to enhance the bottom line and not the technical advancement of the workforce.

I think it would be hard to talk about the education of the workforce while denying opportunities for technical enhancement. The rubber industry offers some quality instruction through the Division, the rubber groups and universities like the University of Akron's Polymer Science Institute. One of the newer and best developed courses is the one sponsored by the New York Rubber Group on "Engineering design with elastomers" which they hold at Stevens Institute of Technology. The developers of this program recognized the potential for elastomers as high-integrity engineering materials. However, there is a low level of appreciation of the unique engineering properties of elastomers and there is difficulty in accessing suitable data for design engineers. This five-day course addresses both shortcomings, and according to previous attendees, they do it extremely well.

But, like the Rubber Division, people aren't beating down the doors to take the course, even though it addresses what is going to be the future of the rubber industry. The speech makers talk a good game now, but when the game passes by all that will be left is the talk.

Don R. Smith
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RubberWorld

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Business Briefs

in Hamilton, OH. The facility contains 75,000 sq. ft. of warehouse space and covered dock, 6,200 sq. ft. of office space and a bulk storage capacity of 700,000 gallons.

Phillips Petroleum will construct a new plant as part of the final step in restoring its annual U.S. polyethylene production capacity to 1.8 billion pounds, the capacity it had in place or under construction prior to the accident at its Houston chemical complex, Oct. 23. Construction is expected to begin in the first quarter of 1991 with start-up in mid 1992. The plant will have a rated capacity of 600 million pounds a year, and will utilize Phillips' loop reactor technology.

Polycoat Systems, Hudson Falls, NY, expanded its territory as a distributor of **Dow Corning's** silicone roofing systems to include the entire East Coast.

DSM Kunstharze GmbH, Meppen, Federal Republic of Germany, a subsidiary of **DSM Resins**, has expanded its resin production to 12,000 metric tons per year with the installation of a computer-controlled batch production line for advanced synthetic resins, such as polyurethane and saturated polyester resins, at an investment of DM 25m.

UCB Chemicals will expand its Ghent, Belgium site of the Film Sector, with the addition of new equipment for high volume printing and laminating for the conversion of packaging films, a third co-extrusion film unit, new devel-

opments in special films and a vacuum metalizing unit.

Swedish-based roller bearing manufacturer, **SKF**, completed the previously announced acquisition of **CR Industries**, a producer of fluid sealing devices.

CR Industries opened a 64,000 square foot warehouse and distribution center in Lenexa, KS. From the facility, the company can provide next day service to customers in adjacent states.

CEM Corporation, a manufacturer of microwave equip-

1990-1994 IISRP forecast - new rubber consumption by region* (thousand metric tons)

Natural rubber	1988	1989	1990	1994
North America	948	981	982	1,030
Western Europe, Africa, Middle East	1,130	1,160	1,185	1,275
Asia and Oceania	1,750	1,740	1,812	2,075
Latin America	212	233	240	278
Total	4,040	4,114	4,219	4,658

Source: IISRP forecast * excluding centrally planned economy countries



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For information, contact Dover Chemical Corp., Dept. S-680, P.O. Box 40, Dover, Ohio 44622, (216) 343-7711.

DOVER CHEMICAL CORP.

Subsidiary of ICC Industries

Business Briefs

ment for laboratory testing and analysis, opened two subsidiaries. CEM Microwave Technology, Ltd., Buckingham, England, and CEM GmbH, West Germany, will provide full sales, service and application support for CEM.

Belgium-based steel wire and steel cord manufacturer, Bekaert, will acquire 40% of the shares of Bremen SA in Spain, a producer of fiber reinforced composites. Bremen has offices and production facilities in Munguia, Vizcaya, Spain.

Polyfol Klepsch, the first European producer of biaxially-oriented polystyrene suitable for thermoformed plastic packaging, is also the first European company to receive a slitter/rewinder capable of handling extruded plastics. The Model 805 slitter/rewinder, manufactured and installed by Dusenbery Europe Limited, the European division of the John Dusenbery Company, is in operation at Polyfol Klepsch's plant in Vienna. The plant was built and equipped to handle an initial capacity of 8,000 tons of BOPS per year in thermoformable gauges between 70 and 700 microns.

Elsevier Science Publishing, New York, NY, acquired a monthly technical report from the Massachusetts Institute of Technology Press, entitled Materials and Processing Report. Terms of the purchase were not disclosed.

Contracts, licenses

Continental AG and VEB Reifenkombinat Fuerstenwalde, the East German state-owned tire company which produces the Pneumant brand tire, have entered into an agreement for a future partnership. The East German company has five manufacturing plants and a retreading plant, which collectively employ 10,500 people. Pneumant's production facilities in East Germany will be modernized, and its top and middle management employees will be trained and familiarized with the conditions of a free market economy, Continental said in a press release.

Mobay appointed Albis of Houston, TX as regional distributor of its line of engineering thermoplastic resins and blends, throughout the southeast United States.

Rhein Chemie was named a distributor for the full line of rubber chemicals marketed by Mobay. Rhein Chemie, Trenton, NJ, will represent Mobay products throughout the U.S., excluding the 11 western states.

The previously announced 50/50 joint venture between Solvay & Cie, S.A. and Dexter has been completed. The venture will develop, manufacture and sell specialty engineered polypropylene-based compounds internationally.

Sumitomo Chemical, Daicel Chemical Industries and Sumitomo Metal Mining will form a joint venture to cooperate extensively in the optical disk business. Optical

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Molsulfide is a registered trademark of AMAX Inc.

1990-1994 IISRP forecast - new rubber consumption by region* (thousand metric tons)

Synthetic rubber	1988	1989	1990	1994
North America	2,581	2,590	2,601	2,820
Western Europe, Africa, Middle East	2,121	1,191	2,238	2,413
Asia and Oceania	1,675	1,723	1,763	2,019
Latin America	454	487	505	568
Total	6,831	6,991	7,107	7,820

Source: IISRP forecast * excluding centrally planned economy countries

1990-1994 IISRP forecast - new rubber consumption by region* (thousand metric tons)

Total rubber	1988	1989	1990	1994
North America	3,529	3,571	3,583	3,850
Western Europe, Africa, Middle East	3,251	3,351	3,423	3,688
Asia and Oceania	3,425	3,463	3,575	4,094
Latin America	616	720	745	847
Total	10,871	11,105	11,326	12,478

Source: IISRP Forecast * excluding centrally planned economy countries

Business Briefs

\$11.7 billion and net earnings after tax totaling \$66.7 million.

British Petroleum reported \$546 million in 1989 fourth quarter replacement cost net income.

Buhler Brothers Ltd. and Buhler-Miag will both be known from here on as just Buhler. The company also redesigned its logo.

Chem Systems Group opened a Chem Systems East Asia Ltd. branch office in Bangkok, Thailand.

Continental reported sales of DM 8.4 billion for 1989, and said its consolidated profits were slightly above 1988's income of DM 195 million.

Cooper Tire reported 1989 net income of \$58.2 million and sales of \$866.8 million. Net sales for the first quarter of 1990 were \$208.6 million and earnings were \$13.7 million.

DSM realized a net profit of f 1.38 billion in 1989. Sales were f 10.8 billion.

Du Pont had a 1989 net income of \$2.48 billion on sales of \$35.53 billion.

Ethyl recorded net income for 1989 of \$231.3 million and net sales from continuing operations of \$2.43 billion.

Firestone is extending its previously-announced recall of tubeless over-the-road truck tires by an additional 89,500 units to include all tubeless tires produced between mid-

1987 and late 1989 at Bilbao, Spain, and imported to the United States.

General Tire will adjust production schedules at two of its plants because of a need to adjust inventories caused by a soft market. Approximately 300 hourly and salaried employees on the weekend crew at the company's Mayfield, KY facility will be placed on indefinite layoff. In addition, a one week production shutdown will be put in place at the Charlotte, NC tire plant.

BFGoodrich Aerospace Division combined its Marine Products & Services and Dynamic Polymer Products units and created a new business which is yet to be named. Headquarters will be at existing MP&S facilities in Jacksonville, FL. The new unit will continue to develop products for the transportation industry.

Goodyear will reorganize its North American tire operations which will create two business units - a consumer tire group and a commercial tire group.

Goodyear's 1989 net income totaled \$206.8 million and sales for the year reached \$10.87 billion. The company's net income in the first quarter of 1990 was \$20.9 million and sales were \$2.7 billion.

M.A. Hanna had net income in the first quarter of \$3.6 million and net sales of \$267.9 million.

Lexington Precision reported a net loss of \$494,000 and

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1990-1994 IISRP forecast - worldwide new rubber consumption by area (thousand metric tons)

	1988	1989	1990	1994
Non-CPEC				
Synthetic rubber	6,831	6,991	7,113	7,821
Natural rubber	4,040	4,114	4,219	4,658
Total new rubber	10,871	11,105	11,332	12,479
% synthetic	62.8	63.0	62.8	62.7
Eastern Europe				
Synthetic rubber	3,020	3,060	3,120	3,400
Natural rubber	342	368	383	413
Total new rubber	3,362	3,428	3,503	3,813
% synthetic	89.8	89.3	89.1	89.6
China/Asian CPEC				
Synthetic rubber	325	350	380	490
Natural rubber	550	590	630	805
Total new rubber	875	940	1,010	1,295
% synthetic	37.1	37.2	37.6	37.8
Total CPEC				
Synthetic rubber	3,345	3,410	3,500	3,890
Natural rubber	892	958	1,013	1,218
Total new rubber	4,237	4,368	4,513	5,108
% synthetic	78.9	78	77.6	76.2
Total World				
Synthetic rubber	10,176	10,401	10,613	11,711
Natural rubber	4,932	5,072	5,232	5,876
Total new rubber	15,108	15,473	15,845	17,587
% synthetic	67.4	67.2	67	66.6

Source: IISRP forecast

Business Briefs

net sales of \$40.5 million for the seven months ended December 31, 1989. The company changed its fiscal year-end from May 31 to December 31.

Manville reported net sales in 1989 of \$2.2 billion and a net income loss of \$196,825.

Measurex had a net income of \$40,682 on revenues of \$285,347 for 1989.

The National Fluid Power Association granted final approval of the standard T2.9.6 R1-1990 - hydraulic fluid power - calibration method for liquid automatic particle counters using latex spheres. The new procedure utilizes NIST-traceable monodispersed latex spheres in oil for primary calibration.

NOVA reported unaudited net income for the fourth quarter of 1989 of \$186 million on revenue of \$4.8 billion.

The Ohio Academy of Science has named nearly 100 Ohio scientists and engineers, recruited by Ohio's Edison Technology Centers and other science and technology centers, to participate as visiting scholars in the areas of biotechnology, polymers, manufacturing sciences, materials science, welding engineering and information technologies. The scholars will visit Ohio's public and private schools to assist teachers, students and school administrators to improve science and technology education.

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A reorganization at Rockwell International will unite the operations of its Butler Polymet unit with its other plastics businesses to share sales, marketing, engineering and manufacturing technologies and capabilities.

The Rubber Research Institute of Malaysia is recommending borax as an alternative to Lindane as a treatment for SMR pallet timber. Borax was found to be more effective for wood preservation than Lindane and less toxic. The use of timber preservative prevents the shipment of wood borers and their eggs around the world.

Yarbrough Elastomer Products, Houston, TX changed its name to DuraQuest, a subsidiary of Duramax. The company manufactures elastomer products.

Markets, news

The International Institute of Synthetic Rubber Producers predicts worldwide consumption of synthetic rubber to surpass 11.7 million metric tons by 1992, with both synthetic and natural rubber increasing at an average yearly rate of 2.1% during a five-year period. Synthetic rubber consumption in the non-centrally planned economies is projected to gain at an average annual rate of 1.9% between 1990 and 1994. During the forecast period, the IISRP predicts Asia/Oceania to see an annual SR growth increase of 2.7%, followed by Latin America's annual SR consumption increase of 2.4% annually. It projects North America's annual SR consumption to grow at a rate of 1.6% while western Europe, Africa and the Middle East region will post gains of 1.5% yearly. The IISRP believes the centrally-planned economies of eastern Europe and Asia will consume 3.5 million metric tons of SR in 1990, rising to approximately 3.9 mmt in 1994. Styrene butadiene rubber consumption, which comprised the largest share of the SR market at 34.8% in 1989, should rise by 191,000 mt between 1990 and 1994. Polybutadiene consumption is expected to maintain its 1989 level at 16% of market share for the next five years.

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Machinery & equipment 1990

Extruders for the feeding of calenders

Practical applications of the short, adjustable MCT cold-feed mixer-extruder

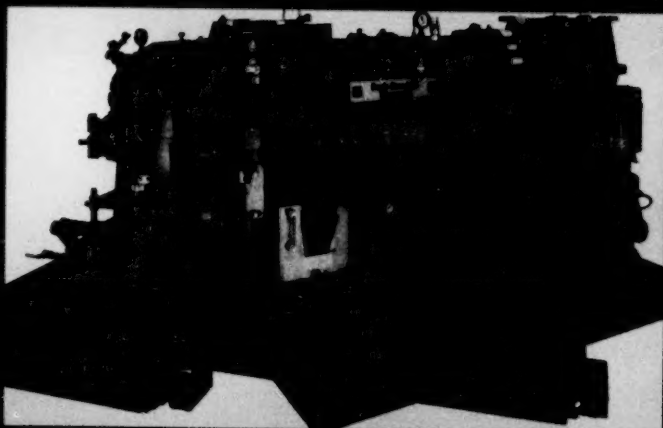
Time uniformity of extrudate melt temperature

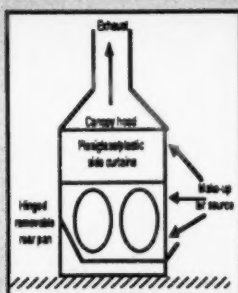
Plus:

Processing equipment directory

Used, rebuilt equipment directory

Corporate Profile '90

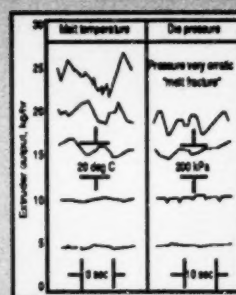




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temperature
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Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.
- 13 Patent News**
edited by Bob Samples, Akron Rubber Development.
- 14 Tech Service: Chemical exposure at work**
by Jon Menough, contributing technical service editor. This column, continued from last month, focuses on the needs and requirements of smaller companies to improve working conditions and reduce worker exposure to chemicals.
- 17 Extruders for the feeding of calenders**
by Gerd Capelle, Berstorff Corp. The advantages of the use of pre-warming extruders over pre-warming mills are described in detail.
- 23 Practical applications of the short, adjustable MCT cold-feed mixer-extruder**
by Paul Meyer, RCM Ltd. The use of the patented Multi-Cut Transermix (MCT) equipment, and especially its place as a step toward continuous compounding and material modification in production, are thoroughly described.
- 27 Time uniformity of extrudate melt temperature**
by George P. Colbert, George Colbert & Associates. The author critically examines the unsteady-state heat transfer model for predicting the temperature variation through a cross section of an extrudate.
- 32 New machinery directory**
Suppliers of new rubber machinery and equipment are listed alphabetically in this directory.
- 38 Used and rebuilt machinery suppliers**
Results of a survey of rebuilt rubber processing equipment suppliers are presented, along with a directory and a grid showing rebuilding capabilities.
- 94 Techno Mart**
New equipment, CAD/CAM, products and materials

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A Lippincott & Peto Publication

Editorial

In preparation for this machinery and equipment issue, we send a packet of forms to those in the used and rebuilding business to ascertain their business climate. Most of the questions are straightforward including a question which usually asks what problems does the industry face. For years the most mentioned problem for the used and rebuilt machinery industry dealt with liability. So much so that it really wasn't considered news anymore.

But this year was different. Liability was displaced by the availability of a skilled workforce. It seems many companies are having a hard time finding skilled machinists to perform the work needed. All of a sudden, the liability problem became news again. Is it no longer a problem and why? Unfortunately the problem hasn't gone away. It appears that many have categorized liability as a part of doing business. It's not going to go away. Attempts have been made to rectify the situation for years with little or no headway and so it appears it is something we're going to have to live with.

But that's not necessarily so says a recent book by Richard Neely, a justice of the West Virginia Supreme Court of Appeals and professor of economics at the University of Charleston. In his book "The Product Liability Mess" he claims business has taken the wrong avenue for redress - namely trying to get laws passed through Congress. Attempts have been made for years with no success, yet more and more money is poured into the political parties and PACs with the hope of changing things. Change that by the nature of politics and politicians will never come about according to Neely.

Neely contends, and his argument is most persuasive, that the avenue to be taken is through the Supreme Court. To those of you that cringe at such a suggestion, read the book. The Court is not anti-business as many believe and its ability to break impasses between the branches of government make it the potential prime mover in liability reform.

As Neely puts it "As long as I am allowed to redistribute wealth from out-of-state companies to injured in-state plaintiffs, I shall continue to do so. Not only is my sleep enhanced when I give someone else's money away, but so is my job security, because in-state plaintiffs, their families, and their friends will reelect me." This thinking can explain many settlements to an accident where there is no discernible neglect of the manufacturer. Settlements that will get larger and larger unless something is done. Something that the legislative and executive branches historically have been unable to do. Neely presents a blueprint for business to finally get redress from the liability problem that is well worth the look.

Don R. Smith
Editor

RubberWorld

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- Blue Book: Materials, Compounding Ingredients, and Machinery for Rubber

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Business Briefs

Acquisitions, expansions

Rubbermaid acquired the privately held Swiss manufacturer and marketer of commercial floor supplies and equipment, EWU AG, for an undisclosed amount of cash. The company's products, which are manufactured and distributed from facilities in Switzerland and the United States, will complement Rubbermaid's domestic commercial sanitary maintenance line. The operation will report to Rubbermaid's Commercial Products Inc., and the company founders, Hans Moench and Dieter Sacks, will continue with the business on a consulting basis.

Pirelli Rubber Flooring opened a warehouse facility in California to serve the California market and western states.

Sumitomo Tire added its sixth U.S. warehouse and office facility, in Edison, New Jersey. The 200,000 square foot warehouse and 2,500 square foot office has begun shipping Sumitomo brand tires.

Cooper Tire & Rubber will begin production of radial passenger tires in the second half of 1991 at its plant in Albany, GA, upon completion of equipment installation and some refurbishing of the facility. The plant and warehouse will comprise 1.8 million square feet.

TRC Industries, Stow, OH, expanded its reclaiming services from the reclaiming of silicone (VMQ, PVMQ) and fluorosilicone (FVMQ) to include reclaiming of fluorocarbon elastomers (FKM), polyacrylates (ACM), ethylene acrylic rubber (EA), neoprene, EPDM, butyl and chlorobu-

tyl. This expansion coincides with a recent doubling of square footage at its distribution center, an increase of 15,000 square feet. The company can also evaluate reclaim possibilities for other polymer types.

ICI Advanced Materials, Exton, PA, a business unit of ICI Americas, will sell its Ultralon coatings assets to Whitford Corporation, Frazer, PA. The agreement includes the Ultralon products currently manufactured and marketed by ICI in North and South America, such as release coatings for rubber molds. Whitford has a line of coatings products that complement the Ultralon release coatings.

Tokyo-based Nippon Zeon Co., and its subsidiary Zeon Chemicals USA, opened Zeon's first American plant, a \$20 million, 3.3 million pound capacity manufacturing facility to produce synthetic rubber in Pasadena, TX. Located in the Bayport Industrial Complex, the facility occupies 15 acres, with 19 acres reserved for future expansion. Some of the raw materials used will be imported from Nippon Zeon's Japanese plants.

Polysar France, part of the Rubber Division of Nova, completed spray-drying facilities for producing Krynac PXL 38-20, a powdered nitrile rubber used in phenolic blends and for plastics modification.

Polysar Gulf Coast in Orange, TX, broke ground for

RMA tire report - March
(figures in thousands of units)

Passenger tires	YTD '89	YTD '90	% change
Shipments			
original equipment	11,376	14,097	-10.3
radial	9,954	12,296	-19.0
replacement	35,245	34,128	3.3
radial	34,036	32,294	5.4
export	3,280	3,435	-5.1
radial	3,092	3,163	-2.2
total	49,901	51,661	-3.4
radial	47,082	47,742	-1.4
Production	45,425	46,431	-2.2
radial	43,669	43,017	1.5
Truck & bus tires			
Shipments			
original equipment	1,853	2,305	-19.6
radial	1,585	1,907	-16.3
replacement	8,452	8,342	1.3
radial	5,237	4,781	9.5
export	946	935	1.1
radial	748	702	6.5
total	11,252	11,583	-2.9
radial	7,580	7,390	2.6
Production	9,938	10,285	-3.4
radial	7,004	6,714	4.3

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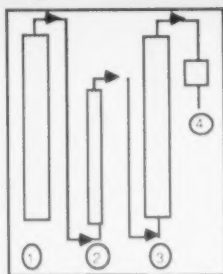
The technical service magazine for the rubber industry

Volume 202, No. 5

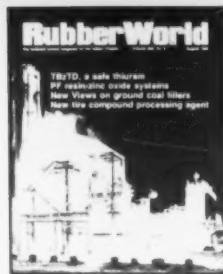
August 1990

TBzTD, a safe thiuram
PF resin-zinc oxide systems
New views on ground coal fillers
New tire compound processing agent

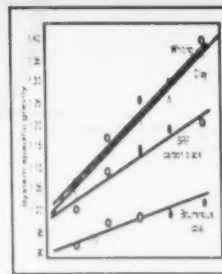




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Acquisitions, expansions; contracts, licenses; corporate, financial news; markets, news.

14 Tech Service: Cleaning up

by Jon Menough, contributing technical service editor. This column reviews the use of plastic media for rubber mold cleaning.

16 Patent News

edited by Bob Samples, Akron Rubber Development.

18 A new safe thiuram, TBzTD

by D.B. Seeberger, Akzo Chemicals. Tetrabenzyl thiuram disulphide, TBzTD, has been developed by Akzo, and is said to be the first safe thiuram that may be able to replace one or more of the currently used thiurams in the rubber industry.

22 New views on using ground coal fillers

by Michael J. Trojan, Keystone Filler and Mfg. Co. and William Klingensmith, Akron Consulting Co. The authors discuss the concept of decreased compound specific gravity, comparing ground coal to other common fillers, to reduce weight and to improve performance parameters in rubber compounds.

27 The effect of PF resin-zinc oxide system as curative for soft thermoplastic NR:PP blends

by Joy Jacob, N.M. Mathew and B. Kuriakose, Rubber Research Institute of India. This article is a study on the use of a phenol-formaldehyde resin/zinc oxide system as a curative for thermoplastic elastomers prepared from a 60/40 NR/PP blend.

33 New processing agent in tire compounds

by S.W. Hong, Uniroyal Chemical Co. In this article, Processing Agent 1109 has been introduced in lower oil tread, replacing oil with PA 1109, conventional tread and high modulus tread compounds.

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New equipment, instruments, products and materials

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Cover photo courtesy of Zeon Chemicals Inc.

A Lippincott & Peto Publication

Editorial

To say that the chemical industry has an image problem would be an understatement. Hardly a day goes by without one form of the media telling you about spills, explosions, illegal dumping, past dumping, etc. In many of the instances there appears to be a blatant disregard by the company involved for the health, safety or environment of their workers, customers and the community they operate in. Unfortunately, a whole industry gets tainted by the transgressions of a few.

The Chemical Manufacturers Association, recognizing this problem of how members are perceived, has developed what it calls Responsible Care - a public commitment. By being a member of the CMA, companies now are committed to support a continuing effort to improve industry's responsible management of chemicals. Members pledge to the following:

- To recognize and respond to community concerns about chemicals and our problems.
- To develop and produce chemicals that can be manufactured, transported, used and disposed safely.
- To make health, safety and environmental considerations a priority in our planning for all existing and new products and processes.
- To report promptly to officials, employees, customers and the public, information on chemical-related health or environmental hazards and to recommend protective measures.
- To counsel customers on the safe use, transportation and disposal of chemical products.
- To operate our plants and facilities in a manner that protects the environment and the health and safety of our employees and the public.
- To extend knowledge by conducting or supporting research on the health, safety and environmental effects of our products, processes and waste materials.
- To work with others to resolve problems created by past handling and disposal of hazardous substances.
- To participate with government and others in creating responsible laws, regulation and standards to safeguard the community, workplace and environment.
- To promote the principles and practices of Responsible Care by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of chemicals.

Many a cynic will shout lip service on this. Like the quality issue, unless management is totally committed, it is nothing but lip service. But these principles are a good starting point, and are principles that can be adopted by any industry.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Witco will expand sulfonate capacity at its Amsterdam facility in the Netherlands to include neutral and overbased calcium sulfonate production, and has completed an expansion of sulfonation facilities in Elbeuf, France to manufacture sulfonic acids.

Zeon Chemicals USA broke ground for a \$7 million U.S. research and development/technical services center in Louisville, KY. The center will cover 36,000 square feet in two buildings, adjacent to the existing headquarters and manufacturing plant.

Exxon Chemical Polymers will construct a plant to produce structural thermoplastic composite materials at Lynchburg, VA. The plant is designed for expansion in line with projected sales growth. The first 15 million lbs./year increment is scheduled for start-up in the first quarter of 1991. Construction will begin immediately following receipt of necessary environmental permits.

Arco Chemical broke ground for a propylene oxide and styrene monomer plant in Channelview, TX. Field construction has begun, with plant startup scheduled for the fourth quarter of 1991. Upon completion, the plant will produce 500 million pounds of propylene oxide, and 1.125

million pounds of styrene monomer annually.

Kline & Company, Fairfield, NJ, opened a full-service business consulting office in Yokohama, Japan, with a full-time staff of consultants, to offer a full range of business consulting and research services in the chemical and allied process industries. The company will continue its affiliation with Diamond, Inc. and will maintain its office in Diamond's Tokyo headquarters.

Bridgestone formed Bridgestone/Firestone Europe S.A. for the overall planning and management of the operations of both Bridgestone and Firestone in Europe. The company is fully capitalized by Bridgestone at 18 million Belgian Francs (about \$510,000).

The Society for the Advancement of Material and Process Engineering moved its international business office to a larger, 14,000 square foot, two story building in Covina, CA.

DSM Resins reached an agreement to acquire the ERF Plastics Ltd. subsidiary of ERF plc (UK). ERF Plastics produces glass fiber reinforced molded parts and assembly components for the automotive transport industries, with outlets in the UK and abroad.

SilMix, Stow, OH added refining, straining, pelletizing, preforming and metal-insert recovery to its services. The expanded services are available on an independent basis as well.

Ometron relocated to larger headquarters in Sterling, VA, where it will continue to manufacture non-contact

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RMA tire report - April (figures in thousands of units)

Passenger tires	YTD '90	YTD '89	% change
Shipments			
original equipment	15,718	19,097	-17.7
radial	13,796	16,675	-17.3
replacement	47,648	46,631	2.2
radial	45,999	44,117	4.3
export	4,456	4,511	-1.2
radial	4,239	4,163	1.8
total	67,822	70,240	-3.4
radial	64,034	64,954	-1.4
Production	60,697	62,255	-2.5
radial	58,297	57,792	0.9
Truck & bus tires			
Shipments			
original equipment	2,486	3,075	-19.2
radial	2,130	2,538	-16.1
replacement	11,378	11,061	2.9
radial	7,073	6,308	12.1
export	1,247	1,243	0.3
radial	1,000	940	6.4
total	15,110	15,379	-1.7
radial	10,203	9,786	4.3
Production	12,897	13,686	-5.8
radial	9,154	8,929	2.5

Business Briefs

290 president James Patisteas that URW workers have been used as a sacrificial lamb to impress stockholders," Stone said. Goodyear decided to close the plant for economic reasons, following discussions between Goodyear corporate and plant officials and local and international URW representatives. The plant's age and market conditions, such as over capacity of roofing products, were said to be key factors which lead to the closing.

• The world's total natural rubber production for 1989 is estimated at 5.054 million metric tons compared with 5.040 mmt for the previous year, an increase of only 14,000 mmt or around 0.3 percent, according to the Malaysian Rubber Research and Development Board. Output from Malaysia and Sri Lanka declined by 14% and 6.1% respectively. Indonesia, Thailand, India and "rest of world" increased production by 2.4%, 4.1%, 9.9% and 21.3% respectively.

Demand for rubber remained strong during the first nine months of 1989, although the year-on-year increase in demand was slightly less than that registered during the same period in 1988. The strongest increase during the nine-month period was recorded for France, at 14.5%, followed by the U.S. (6.7%), China (6.6%), and India (6.5%).

World rubber consumption for the third quarter of 1989,

3.775 million metric tons, was 3.4% above that of the third quarter of 1988. Strong demand was noted in the U.S., France, the U.K., West Germany and China.

Demand for NR during January to September 1989 was better than for SR, rising 4.9% above the level a year before to 3.995 million metric tons. Strong increases were registered for West Germany, the U.S. and China; Japan, South Korea and the U.K., however, reduced uptake by 3.1%, 5.6% and 13.7% respectively. During this period, the ranking of the top five NR consuming countries remained almost unchanged from the first half of the year, with the U.S. as the largest consumer, followed by Japan, China, India and South Korea; West Germany was the fifth largest in the first half of the year, according to the MRRDB.

• For the fourth year in a row, unemployment among chemists has hovered close to the 1% mark, while their median salaries rose about 5% in step with inflation, according to the annual salary survey in *Chemical & Engineering News*, the American Chemical Society weekly magazine.

The four-year streak is the longest since ACS began collecting such data in 1971, the survey notes. The chemists' 1.1% unemployment rate as of March 1 is far below the 5.2% rate for the U.S. civilian labor force as a whole, and even below the 1.8% rate for all managerial and professional employees.

The median base salary for chemists at all degree levels as of March 1 was 5% higher than a year earlier, continuing the same moderate trend of recent years, the survey says. This trend has done little more than keep pace with the rise in consumer prices, it notes.

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World rubber consumption, third quarter 1989

	NR & SR		NR	
	'000 tonnes	% chg ^a	'000 tonnes	% chg ^a
USA	725.2	+4.8	228.1	+15.5
UK	92.5	+9.5	31.0	-11.4
France	125.6	+23.3	40.2	-2.0
West Germany	163.7	+5.8	52.1	+13.3
Italy	n/a	—	32.0	+18.5
Other W. Europe	199.0	+3.6	75.0	+4.2
Eastern Europe	832.0	-4.4	82.0	-13.7
India	106.8	+2.7	83.7	+8.7
Japan	428.6	+3.0	156.0	+1.0
China	231.0	+6.2	155.0	+5.1
South Korea	121.5	-16.7	59.2	+9.2
Asia ^b	258.5	+12.8	168.3	+8.0
Latin America ^c	119.5	+8.6	46.5	+9.4
Africa	58.0	+5.5	29.0	+3.6
All others	n/a	—	56.9	-0.4
World Total	3,775.0	+3.4	1,295.0	+5.3

a - % change from corresponding quarter 1988

b - excluding Japan, China, India and South Korea

c - excluding Brazil

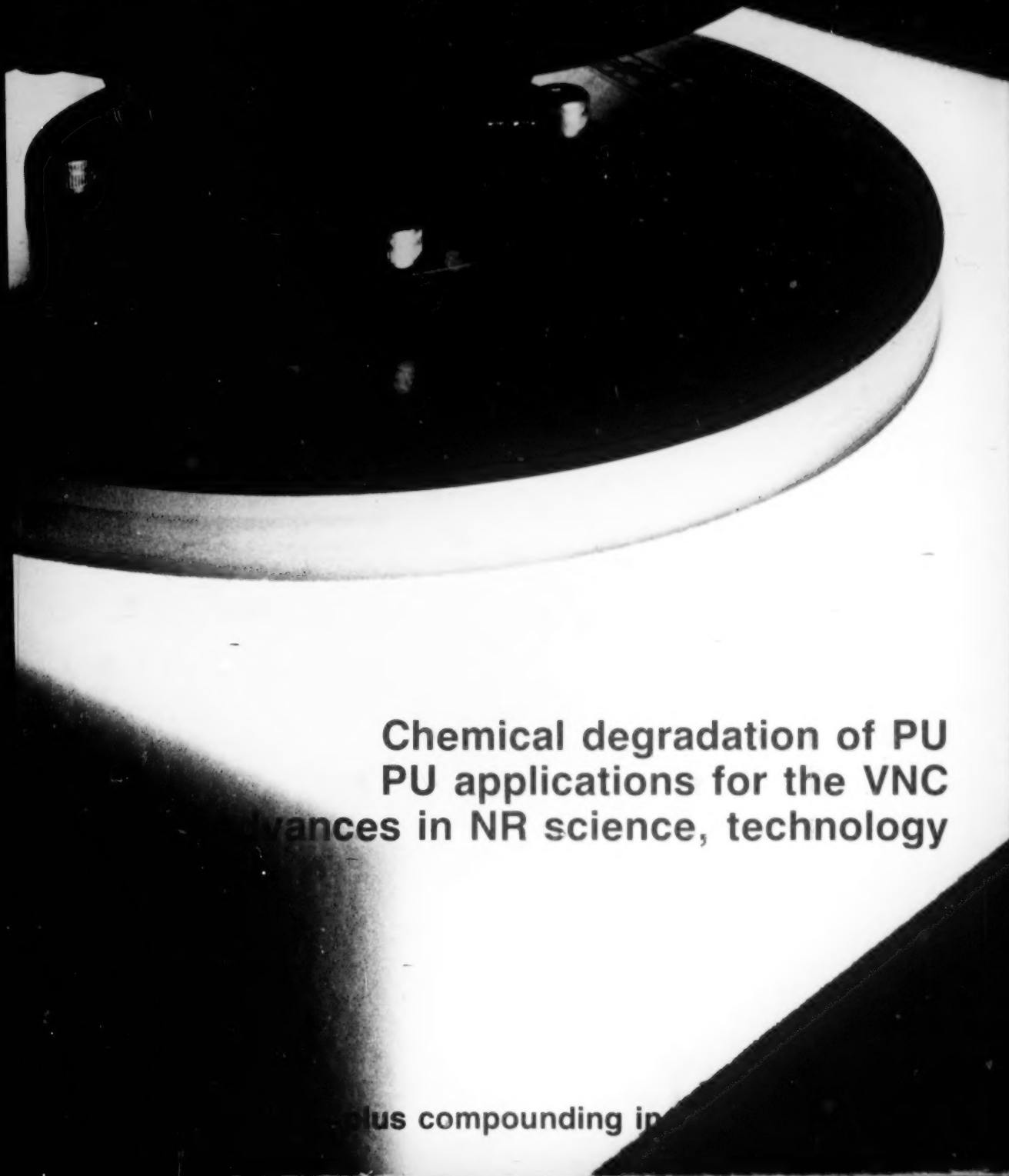
Source: MRRDB

RubberWorld

The technical service magazine for the rubber industry

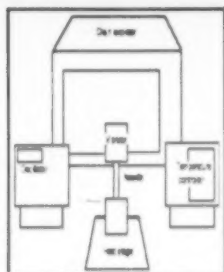
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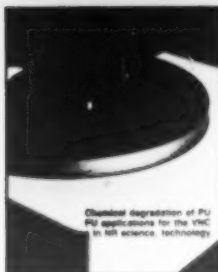


Chemical degradation of PU
PU applications for the VNC
Advances in NR science, technology

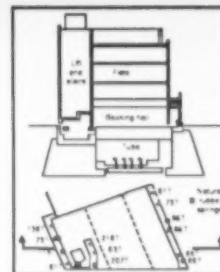
plus compounding in



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by Jon Menough, contributing technical service editor. This column reviews the importance of accurate test data, with particular emphasis on tensile data.

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edited by Bob Samples, Akron Rubber Development.

15 Chemical degradation of polyurethane

by Vincent Gajewski, Uniroyal Chemical Co. The author reviews the various modes of chemical degradation of polyurethanes and suggests stabilizers to improve longevity.

19 Polyurethane applications for the vibrating needle curemeter

by Keith W. Scott, Rapra Technology Ltd. The characteristics and advantages of this new technique are described for monitoring continuously the cure of liquid systems.

24 Advances in NR science and technology

by C.S.L. Baker, Malaysian Rubber Producers Research Association. The author describes the important developments in natural rubber, including epoxidized, liquid and thermoplastic, as well as modern compounding techniques and protection from earthquakes.

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Cover photo courtesy of ICI Polyurethanes.

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Editorial

Let's hope the Rubber Manufacturers Association can work out a tire recycling bill with Congress that is fair and equitable. The domestic rubber industry hardly needs any more obstacles in attempting to produce quality, competitively priced goods in today's market. The Tire Recycling Incentives Act, presently working its way through Congress, needs some amending and rework and hopefully it will be done before it comes out of committee. The bill calls for expanding the markets for recycled rubber through a complicated credits program that would ultimately lower the cost of items made with recycled rubber.

The RMA has been on top of this bill since its introduction earlier this year. The association's opposition to the bill has spawned a debate between the bill's sponsors and the RMA. A good, healthy debate that can only enhance the chances of legislation being passed that the industry can live with. It is also an opportunity for the rubber industry to educate not only congresspersons but the general public about the technology in the industry. It seems the bill's authors perceive tires as low tech items. They, like most outside of the industry, see tire manufacturing only from the production worker removing the tire from the curing press. They don't see the research, development and engineering involved in not only the tire, but all of the materials in its composition. The demands of the automakers on rubber products, especially tires, cannot be met by increasing scrap rubber usage in the product.

It's good to see Congress addressing the enormous waste problem. It's also good that Congress sees the need for providing incentives for the use of recycled rubber. But the carrot, as the bills sponsors call it, appears to be in the wrong place. We feel, as the RMA has pointed out, Congress can create incentives for scrap rubber usage in highway pavement projects or as a source for fuel, to name two. Congress could also provide incentives for research into increasing the usage of recycled rubber in rubber products.

Even though the RMA would like to see the bill scrapped entirely in favor of working with state governments, it's doubtful a scrap tire bill won't be passed. This legislation is attractive to the lawmakers. They get to act on a visible environmental issue that doesn't directly affect most of their constituents. Government initiative can be a good thing. The history of the synthetic rubber industry is a testament to that. The federal government's decision to build an interstate highway system was also a boon. But the present language in the Tire Recycling Incentives Act doesn't create new markets or address the issue of the quality of the less expensive goods. Hopefully the RMA can make this legislation not only palatable for the industry but something that would truly be an incentive.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Yokohama Rubber of Japan plans to increase **Mohawk Rubber's** tire capacity from 4.1 million units per year to 5.3 million by 1991, with an initial investment of \$40 million. According to the plan, Mohawk, headquartered in Akron, OH, with production facilities in Salem, VA, will produce Yokohama-brand radial tires for passenger cars and light trucks in the replacement market by the end of the year, in addition to existing production of Mohawk-brand and private brand tires. Yokohama also intends to supply OEM tires in North America, and plans to increase capacity to 10 million units per year by the mid-1990s. Total investment will reach \$200 million, and will include the addition of 100 employees by 1991.

Rubbermaid, Wooster, OH reached a definitive agreement to buy **Eldon Industries** through a stock exchange where Eldon stockholders will receive Rubbermaid stock with each Eldon share being converted. The publicly-held, Inglewood, Calif.-based company's office products segment consists of the Eldon Office Products Division, offering office accessories, and Davson Division, which markets communications boards, building directories, signage and conference room items under the Davson name. The agreement has yet to be approved by Eldon stockholders and the appropriate regulatory bodies.

Muehlstein's Rubber Division established offices in the United Kingdom, Hamburg and Milan and will establish a global headquarters in London for the Division.

Two tire testing courses, one for wet handling and one for dry handling, were added at **General Tire's** proving grounds at Uvalde, Texas, as part of a multi-million dollar expansion, allowing evaluation of tire performance on a variety of vehicles on an unlimited number of course configurations.

Allied-Signal plans to construct a \$160 million plant for the manufacture of polyester fiber used for passenger car tires, seat belts and other industrial applications in Longwy, France. When operational in 1993, it will employ about 300. Allied-Signal has another polyester plant in Moncure, NC.

Akron Standard moved into larger facilities to expand its tire mold and segmental mold mechanism manufacturing capabilities to three times that of the previous facility.

Arco Chemical moved its Automotive Sales and Marketing Center into expanded offices in Southfield, MI, to house its project evaluations, application development, material selection and troubleshooting services.

Du Pont, Wilmington, DE, will double capacity for dodecanedioic acid (DDDA), an intermediate for nylon, at the Victoria, TX, plant by 1993.

Witco purchased the stearates division of **B.G.R. Chemical Products** in Pointe-Claire, Quebec, Canada, for an un-

RMA tire report - May
(figures in thousands of units)

Passenger tires	YTD '90	YTD '89	% change
Shipments			
original equipment	20,600	24,095	-14.5
radial	18,101	21,019	-13.9
replacement	61,240	59,577	2.8
radial	59,166	56,348	5.0
export	5,625	5,528	1.8
radial	5,347	5,115	4.5
total	87,464	89,200	-1.9
radial	82,614	82,482	0.2
Production			
radial	75,540	78,031	-3.2
radial	72,488	72,553	-0.1
Truck & bus tires			
Shipments			
original equipment	3,193	3,884	-17.8
radial	2,721	3,213	-15.3
replacement	14,392	14,011	2.7
radial	8,889	8,019	10.8
export	1,530	1,546	-1.0
radial	1,228	1,160	5.9
total	19,115	19,441	-1.7
radial	12,838	12,391	3.6
Production			
radial	16,045	16,999	-5.6
radial	11,395	11,136	2.3

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Business Briefs

disclosed amount of cash, including manufacturing technology and equipment that will be installed at **Witco Canada's** Oakville, Ontario facility. Witco has a stearates plant due on stream in early 1991 at Houston, TX, as well as existing plants in Chicago, IL, Perth Amboy, NJ and Cuautitlan, Mexico.

UCB will increase its shareholding in the Japanese pharmaceuticals company **Choseido Seiyaku Ltd.**, at Tokushima, to 49% as part of an expansion strategy to develop activities in Japan. The company produces medical products.

Amoco Chemical will increase annual capacity for ethylene by about 600 million pounds and propylene capacity by about 200 million pounds after completion of a \$200 million expansion at its olefins production facility at the Chocolate Bayou plant near Alvin, TX, in early 1994. Current ethylene capacity is 2.4 billion pounds and propylene capacity is 800 million pounds. The increased propylene capacity will be used as feedstock for the previously announced \$90 million polypropylene unit being constructed at the same site.

Amoco Chemical will construct a 23,000 tons per year trimellitic anhydride unit at its Geel, Belgium facility. TMA is used in high-temperature wire enamels, high-

performance plastics, powder coatings and specialty high-temperature and extractable-resistant plasticizers for polyvinyl chloride. The plant will use Amoco's proprietary Mid Century oxidation process, and should be operational by early 1993. The company also has a TMA plant at Joliet, IL.

Alusuisse-Lonza's Organic Chemicals Division, through **Alusuisse of America**, acquired **Cyclo Products** and its affiliate, **Balenco Enterprises**, both located in Los Angeles, CA. The two firms manufacture fine chemical intermediates which will boost Lonza's North American share of fine chemicals. The acquisitions will also have access to the worldwide distribution network of the Alusuisse-Lonza group.

The **Association of Consulting Chemists and Chemical Engineers** established a midwest office in the Chicago area. The association supplies speakers on a broad range of topics related to the management of business and technology.

Farrel opened an office in Charlotte, NC to serve the Southeast region of Florida, Alabama, Georgia, North and South Carolina, Tennessee and Virginia. An office was opened in Kitchener, Ontario, to serve the Canadian market. Farrel supplies polymer processing machines, parts, service and technology.

Applied Color Systems, Lawrenceville, NJ, completed a 28,000 square foot, two-story building addition, housing expanded manufacturing facilities and a new technical support center.

Bohlin Reologi AB, a Swedish producer of rheological instrumentation, will move into new offices near Ideon in Lund, Sweden, to provide additional space for application laboratories, product development, courses and consultation.

The **American Society for Nondestructive Testing** moved into a 17,750 square foot headquarters building in Columbus, OH, to house additional office space, a new

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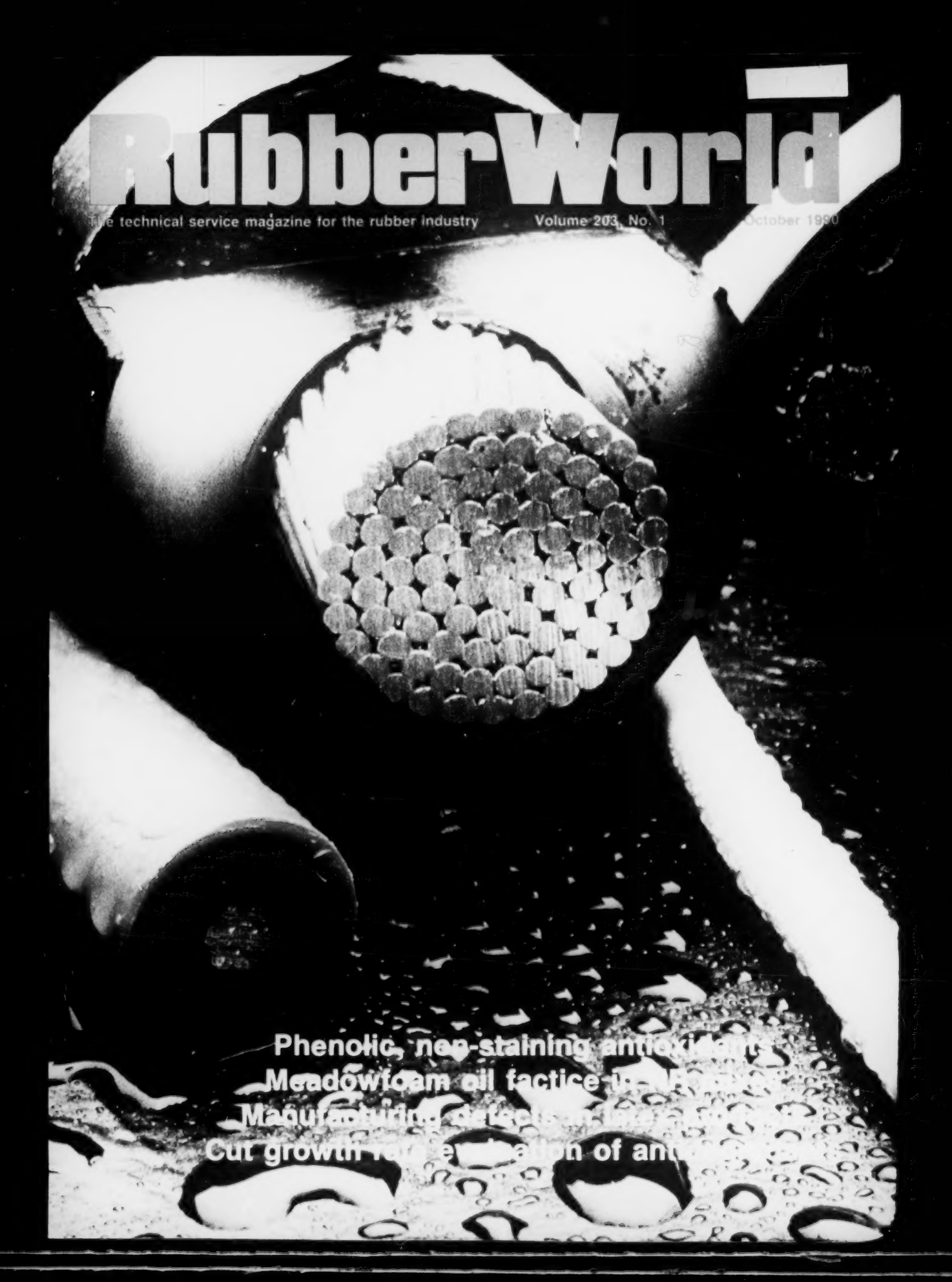
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U.S. tire and tube imports
(units in thousands)

	YTD '89	YTD '90	% Chg.
Passenger radial	17,064	17,316	1.5
Passenger all other	1,356	1,445	6.6
Light truck radial	991	1,447	45.9
Light truck all other	266	185	-30.5
All other truck radial	1,693	1,811	6.9
All other truck	1,550	1,388	-10.4
Source: RMA		Figures through May	

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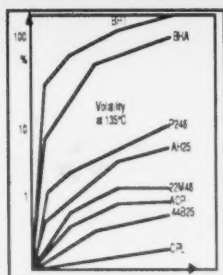


The technical service magazine for the rubber industry

Volume 203, No. 1

October 1990

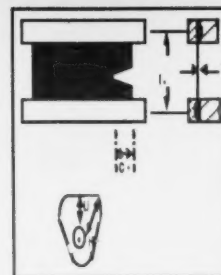
Phenolic, non-staining antioxidant
Meadowcam oil factice in NR
Manufacturing defects in
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by Jon Menough, contributing technical service editor. This column looks at the occupational health disorder CTD, a work related problem that is caused by repetitive motion.

18 Patent News

edited by Bob Samples, Akron Rubber Development.

21 Phenolic, non-staining antioxidants - a guide to select the right product

by Bernd Hansemann, Lowi Chemical Corp. A review is presented of the common, non-staining antioxidants according to chemical type, volatility and test methods.

28 Visualization of manufacturing defects in latex gloves and condoms

by Barbara A. Krop, Jon P. Casamento and T. Whit Athey, U.S. Food and Drug Administration. The authors discuss the nature and frequency of defects found in a study of dipped goods and relate the defects to origin in the dipping or curing process.

33 Meadowfoam oil factice and its performance in natural rubber mixes

by Selim M. Erhan and Robert Kleiman, United States Department of Agriculture. The authors make a case for using factice in rubber compounding, especially one identified as *Limnanthes alba* which contains over 95% unsaturated fatty acids capable of vulcanization reactions.

38 Cut growth rate evaluation of antidegradants in model tire sidewall compounds

by Navnit B. Upadhyay and W. Warrach, Mobay Corp. A study is presented of the effect of chemical protective agents on representative tire compounds using a clever modification of the standard fatigue-to-failure test to obtain fundamental crack-growth properties.

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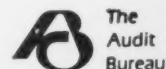
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A Lippincott & Peto Publication



Editorial

It's too bad that a recent president is no longer in office because he could utter one of his famous sound bites "there you go again" at the end of this. Because once again our form of government is going to practice its version of checks and balances when the current occupant of the White House vetoes the Textile, Apparel and Footwear Trade Act of 1990. It's a similar version of the bills vetoed by his predecessor in 1985 and 1988.

The bill (H.R. 4328) hasn't been vetoed yet, but it will as indicated, and like the two previous measures, it will fall just short of having the veto overridden in Congress. If you need a short civics lesson, more than two-thirds of both houses of the legislative branch of government are needed to overturn a 1-0 vote by the executive branch. Now for a short history lesson. This legislation has been favored by more than 66% of the Senate but just less than 66% of the House. The International Trade Commission has unanimously found need for this legislation at least twice in the past five years.

But this administration argues, just as the previous administration did, that this legislation is bad because it denies the American public the opportunity to buy inexpensive goods. Nothing is mentioned of the fact that without some sort of legislation like this, there will be fewer and fewer people being able to afford the inexpensive items because their jobs have been eliminated.

This bill, like the previous two, does not ask for a rollback on imports. In fact, it allows imports a one percent increase per year based on the previous year's totals. Also, those countries that increase their imports of U.S. agricultural goods would be allowed a higher quota as would the countries that are adversely affected by the measure.

It's unfortunate that a minority can control trade policy at the expense of the domestic industries. We urge you to become more familiar with this legislation and find out how your representatives in Washington are voting. All it's going to take to pass this measure is a switch of a couple of votes. To those attending the Rubber Division meeting in the capital this could be an ideal time to get more information on the legislation by visiting the Fiber, Fabric and Apparel Coalition for Trade or the Footwear Industries of America. Also, you could make a little trip to your representative's office should he/she not be voting the way you feel they should be.

Don R. Smith
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RubberWorld

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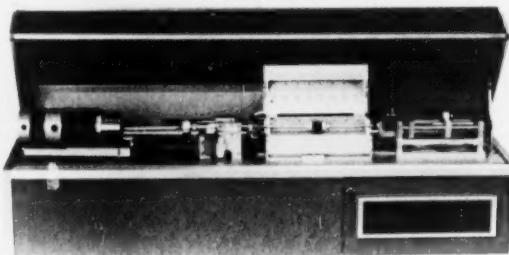
Business Briefs

Acquisitions, expansions

Continental AG, Hanover, West Germany received a proposal from **Pirelli SpA**, Milan, and **Pirelli Tyre Holding N.V.**, Amsterdam, calling for, among other things, the acquisition of Pirelli's tire business by Continental. The proposal is aimed at unifying into Continental the world tire activities of both groups. Continental is reviewing the proposal to determine if it is in the interest of the corporation.

Cabot, the Waltham, MA-based supplier of carbon black has expansion plans set for 1990 that will include a debottlenecking at its Ohio River plant in West Virginia to add 30 million pounds of capacity; expansions in Malaysia, Venezuela and Brazil that will add 54 million lbs., 32 million lbs. and 86 million lbs., respectively; an expansion at Shanghai, China to add 66 million lbs. for rubber applications; an expansion at Kashima, Ibaraki prefecture, Japan that will add 20 million lbs. by 1991 to support special black markets; and an increase scheduled for construction in 1991 at Cilegon, West Java to add 66 million lbs. Cabot will have added 526 million pounds (237,400 metric tons) of capacity to the world's supply in the 1989-1992 period, the company reported. Additional capacity expansions are planned for Eastern Europe.

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Hercules opened a 17,000 square foot technical facility in Jefferson, PA to supply hydrocarbon resins to manufacturers of rubber and engineered plastics. Located within Hercules' hydrocarbon resins plant, the center's capabilities for the rubber industry include synthesizing unique hydrocarbon resins that are compatible with a wide variety of elastomeric polymers for tires, technical rubber goods, and molded and extruded engineered plastics applications.

Columbian Chemicals, Atlanta, GA, opened a \$2.25 million European Central Laboratory in Avonmouth, England to serve carbon black customers throughout Europe. Housed in a specially designed 7,500 square foot building adjacent to its Sevalco plant, the laboratory includes state-of-the-art testing instrumentation, a colloidal and analytical department and an applications department to cover all carbon black and rubber applications.

Bridgestone/Firestone acquired majority interest in its Mexican affiliate **Hulera El Centenario, S.A.**, through a purchase from private investors. Based in Mexico City, the affiliate employs 1,100 and manufactures Firestone-brand tires at plants in Mexico City and Cuernavaca, and markets and distributes Firestone and Bridgestone-brand tires throughout Mexico.

Arco's proposed acquisition of the propylene glycol and urethane polyether polyols businesses of **Union Carbide Chemicals and Plastics** has been approved by the **Federal Trade Commission**, based upon several conditions. Arco's

RMA tire report through June (figures in thousands of units)

Passenger tires	YTD '90	YTD '89	% change
Shipments			
original equipment	25,270	28,511	-11.4
radial	22,199	24,893	-10.8
replacement	75,350	74,608	1.0
radial	72,768	70,711	2.9
export	6,694	6,471	3.4
radial	6,368	6,002	6.1
total	107,314	109,589	-2.1
radial	101,335	101,605	-0.3
Production	90,658	93,070	-2.6
radial	86,873	86,646	0.3
Truck & bus tires			
Shipments			
original equipment	3,834	4,598	-16.6
radial	3,259	3,809	-14.4
replacement	17,662	17,178	2.8
radial	11,045	9,945	11.1
export	1,811	1,834	-1.2
radial	1,452	1,373	5.8
total	23,307	23,610	-1.3
radial	15,756	15,126	4.2
Production	19,112	20,273	-5.7
radial	13,597	13,347	1.9

Business Briefs

Water Management Systems Europe business for W.R. Grace's mold release business. The transaction will include a net cash payment to Dexter by Grace and will result in a capital gain for Dexter. The deal is expected to be completed by the end of the year. Grace's mold release business will be merged into Dexter's Adhesives & Structural Materials Division. Dexter's water management systems business will be integrated into Grace's water treatment service in Dearborn, and its process chemicals services.

Dexter signed a letter of intent to purchase the assets of Moore Plastics of Cleveland, OH, subject to the execution of a mutually satisfactory purchase and sale agreement. If completed, the business would be operated as part of Dexter's Adhesives & Structural Material Division. Moore Plastics develops preformed sealants for acoustical damping sold primarily to the North American industry. The business will fit comfortably with Dexter's proposed acquisition of Ciba-Geigy's preformed sealants business.

Evode Group p.l.c. of Stafford, England finalized its purchase of Dexter's polyvinyl chloride compounding and extrusion businesses located near Charlotte, NC and other facilities in Newark, NJ and Orlando, FL.

Du Pont's Safety and Environmental Resources unit has

developed two consultation programs to help companies identify ways to reduce the generation of waste, and to assess a facility's policies and procedures for regulatory compliance, hazardous waste handling, emergency preparedness or other environmental concerns. The latter program will help the client put the proper systems in place to ensure compliance with the required federal, state and local environmental regulations.

The completion date for Allied-Signal's 35 percent capacity increase at its oxidized high density low molecular weight polyethylene plant has been set for the end of 1990.

Houston, TX-based Shintech's wholly owned subsidiary K-Bin has begun a multimillion-dollar expansion of rigid PVC compounds at K-Bin's Freeport, TX, manufacturing facility. The 500% expansion, which will increase capacity from 20 million pounds to more than 100 million pounds per year of rigid PVC compounds, is projected to be on stream by summer of 1991.

Dynisco, Sharon, MA, acquired Normag Corp., a supplier of processing and monitoring equipment and systems for the plastics, rubber and chemical industries. The Hickory, NC company will operate as an independent wholly owned subsidiary of Dynisco, which manufactures instrumentation and testing equipment for the plastics, transportation and test and measurement markets.

Chemie Linz GmbH, Austria, increased capacity to produce levulinic acid for worldwide consumption by 1,200 metric tons at its plant in Linz, Austria. Levulinic acid is an intermediate used in the manufacture of esters, diphenolic acid and other derivatives for the adhesives industry.

Standard Products, Cleveland, OH, purchased through its Holm Industries subsidiary, a substantial part of the assets of the Plastic/Magnetic Products Division of Pantasote, Greenwich, CT. The business manufactures extruded and molded plastic and magnetic components, and has plants in Seymour, IN; Hartselle, AL; New Ulm, MN; and San Diego, CA. Holm Industries supplies extruded plastic and magnetic door seals. Details of the acquisition were not announced.

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Automotive polymer applications - 1998

(Cars & light trucks made in U.S. & Canada)

Upholstery	346 million lbs.
Fuel systems	187 million lbs.
Electrical	201 million lbs.
Body panels	329 million lbs.
Front/rear end	388 million lbs.
Exterior trim	142 million lbs.
Structural	134 million lbs.
Large functional	999 million lbs.
Small mechanical	276 million lbs.
Flexible	218 million lbs.

Source: Automotive Industries

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Business Briefs

Hoechst Celanese will build a polyphenylene sulfide plant in Chatham, NJ, which it will operate as a joint venture with **Kureha Chemical Industry**, of Japan. Scheduled for startup in 1993, the plant will have an initial capacity of 3,000 tons of Fortron PPS which will double by 1995. This will be Hoechst's second PPS plant in the U.S.

Avery's Specialty Tape Division installed a multi-million dollar pilot scale coater/laminator into a specially built addition of its research and development facility in Painesville, OH. The coater/laminator will be used to speed up the product development process for pressure sensitive adhesive products.

JPS Elastomerics formed the Environmental Products Division to expand its product offerings for environmental applications. Renamed from the Containment Membrane Division, it will develop new products as well as support the sales and marketing of existing geomembrane products.

Contracts, licenses

Ford Motor chose **General Tire's** XP 2000AS all-season high-performance radial tire as original equipment for its Taurus police car. The H-speed rated tire marks the first time that General Tire was awarded business as the standard option on a police vehicle. The XP 2000AS, introduced in 1988, has optimal wet and dry handling.

A reciprocal information-sharing arrangement has been formed between **Footwear Industries of America (FIA)** and the **Shoe Manufacturers Association of Canada (SMAC)**. Terms of the arrangement allow each association to use the other's collection service to collect accounts in the other's country; allows each to attend the other's conferences, workshops and seminars at member prices; and allows each to obtain the other's publications at member prices.

Jefferson Rubber Works, Worcester, MA, was awarded a multimillion dollar contract by **Harvard Industries/Kingston-Warren** to produce rubber components for a

new **General Motors** body style for the 1992 models. The contract will require the company to increase the work force when production begins in mid-1991.

Reed Plastics, a division of **Sandoz Chemical** headquartered in Holden, MA, appointed **General Polymers** as exclusive distributor for the entire line of Reed engineered concentrates in Puerto Rico. The agreement includes all Reed color and additive concentrate lines.

Firestone Building Products selected **G.W. Schuh Associates**, O'Fallon, MO, to represent the Firestone modified bitumen product line in the St. Louis market.

Dexter Adhesives & Structural Materials Division selected **Hanil Advanced Materials** of Seoul, Korea as manufacturer's representative for **Hysol Aerospace Products**.

Corporate, financial news

American Biltrite reported net earnings of \$682,000 on sales of \$40.18 million for the second quarter. For the first half of the year, net earnings were \$1.2 million on sales of \$80.91 million.

Dunlop Tire's medium truck radial tire manufacturing facility in Buffalo, NY is matching company expectations

Estimated polymer usage
in U.S. automotive OEM

Polymer Material (millions of lbs.)	1991	1996
Nylon	208	240
Polyethylene	143	169
Polypropylene	400	465
Unsaturated polyester	203	223
Epoxy	4	5
Polyurethane foam	200	225
Polycarbonate	61	66
Thermoplastic elastomers	115	133
Others	48	67

Source: Automotive Industries

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